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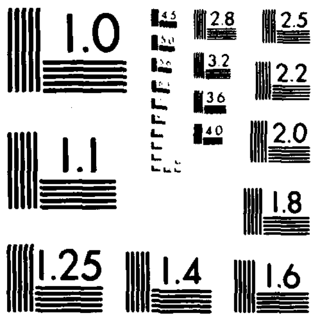
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LEVEL II

Concepts Evaluation Model (CEM) Design Specifications for:

(1) Attrition and Calibration
(2) Fixed Fortified Defense

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FINAL REPORT

Prepared By:

John E. Shepherd
Tactical Warfare Operations

December 1979

OPERATIONS ANALYSIS GROUP

GENERAL RESEARCH CORPORATION

A SUBSIDIARY OF FLOW GENERAL INC.

7655 Old Springhouse Road, McLean, Virginia 22102

Submitted To:

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Office Deputy Chief of Staff for Military
Operations and Plans, DAMO-ZD
Room 3A538
The Pentagon
Washington, D.C. 20310

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Calibration of theater model attrition calculations to that of a high-resolution model and improved representation of theater defensive concepts.

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1 BACKGROUND

The Concepts Evaluation Model (CEM) is a theater combat simulation model which resolves combat at the Blue brigade and Red division level. As with all combat simulation models, input derivation for attrition and maneuver data is a major task. The basic structure of the CEM inputs include (1) the weapon characteristics for the battle engagements and (2) the resources available to each opposing side (Red and Blue).

One of the basic ingredients in the weapon characteristics description, as used in the CEM, is the "firepower potential." This is a number (value) derived for each weapon type, for each engagement type, as a function of the quantity of expected rounds expended, the lethal area of a round, a correlation coefficient which equates lethal area to the probability of kill and a battle intensity factor. These firepower values are used in the CEM to compute the combat attritions and FEBA movements. Built into these numbers and the algorithm to compute the attrition is:

1. *All shooters have an equal capability* to engage all targets, thus the firepower is equally distributed among all targets.

2. In any type of engagement each weapon expends an expected quantity of rounds regardless of the quantity of targets.

3. The allocation of fire fails to include variations in target availability.

This report documents a proposed attrition and calibration process intended to offset these present shortcomings. This new attrition process is centered around an algorithm developed at the US Army Concepts Analysis Agency by Dr. Alan Johnsrud. Its principal feature is its use of battle attrition, as generated by a high-resolution model, to calculate attrition for differing combat situations.

2 SPECIFIC TASKS

The objective of this study was to assist in the modification of the Concepts Analysis Agency (CAA) version of the CEM in support of follow-on effort to the Army Heavy/Light Forces Study; specifically, by developing an improved capability for calibration of the CEM's attrition calculations to that of a high-resolution model and improved flexibility in CEM to represent variations in theater defensive concepts.

The report is divided into two sections. The first section describes Dr. Johnsrud's algorithm, the design of the proposed attrition process (algorithm) in the CEM and the results of some computer generated parametric variations of the algorithm. The second section of this report describes the new rule structure and logic for the CEM to simulate fixed fortified defensive lines.

The FORTRAN program used to test the attrition algorithm is contained in the appendix. This program was originally programmed by Mr. Jerry Schultz of the US Army Concept Analysis Agency (CAA) and modified by the author. The program currently resides in the CAA Univac Computer under the file name "24-ATRITT."

3 DESCRIPTION OF ATTRITION ALGORITHM W/CEM DESIGN SECTION I

The proposed attrition algorithm is centered around the results of a high-resolution combat simulation model. The algorithm, as previously stated, is designed to extrapolate the attrition results (killer/victim scores) from those generated by the high-resolution model to those appropriate to combat situation as generated by the CEM. This extrapolation includes the effects of fire allocation as a function of target and shooter availability. The required data inputs take the form of:

1. The quantity of weapons, by type, killed by each type of shooter (killer/victim scores).
2. The quantity of rounds fired at each type of weapon by each type of shooter.
3. The quantities of weapons of each type on each side.
4. The stowed load of ammo (rounds) with each type of weapon.

The particular advantage of using the killer/victim scores is that they reflect the engagement attrition as simulated in the high-resolution model as a function of:

1. Target acquisition
2. Fire allocation and ammo expenditure
3. Target and shooter availability

These killer/victim scores are also influenced by sensors, intelligence, communication, and the weather conditions which existed in the high-resolution model. These conditions will carry forward throughout the CEM; i.e. careful attention to the quality of the scenario and data input to the high-resolution model is required.

Figure 1 is a macro flow diagram showing the sequential process from the generation of killer/victim scores to the attrition calculations in the CEM. The proposed attrition algorithm is set up in two phases. The first phase (see Figures 1 and 2) resides in the CEM preprocessor. Its function is: (1) read (tape or disk file) the killer/victim scores

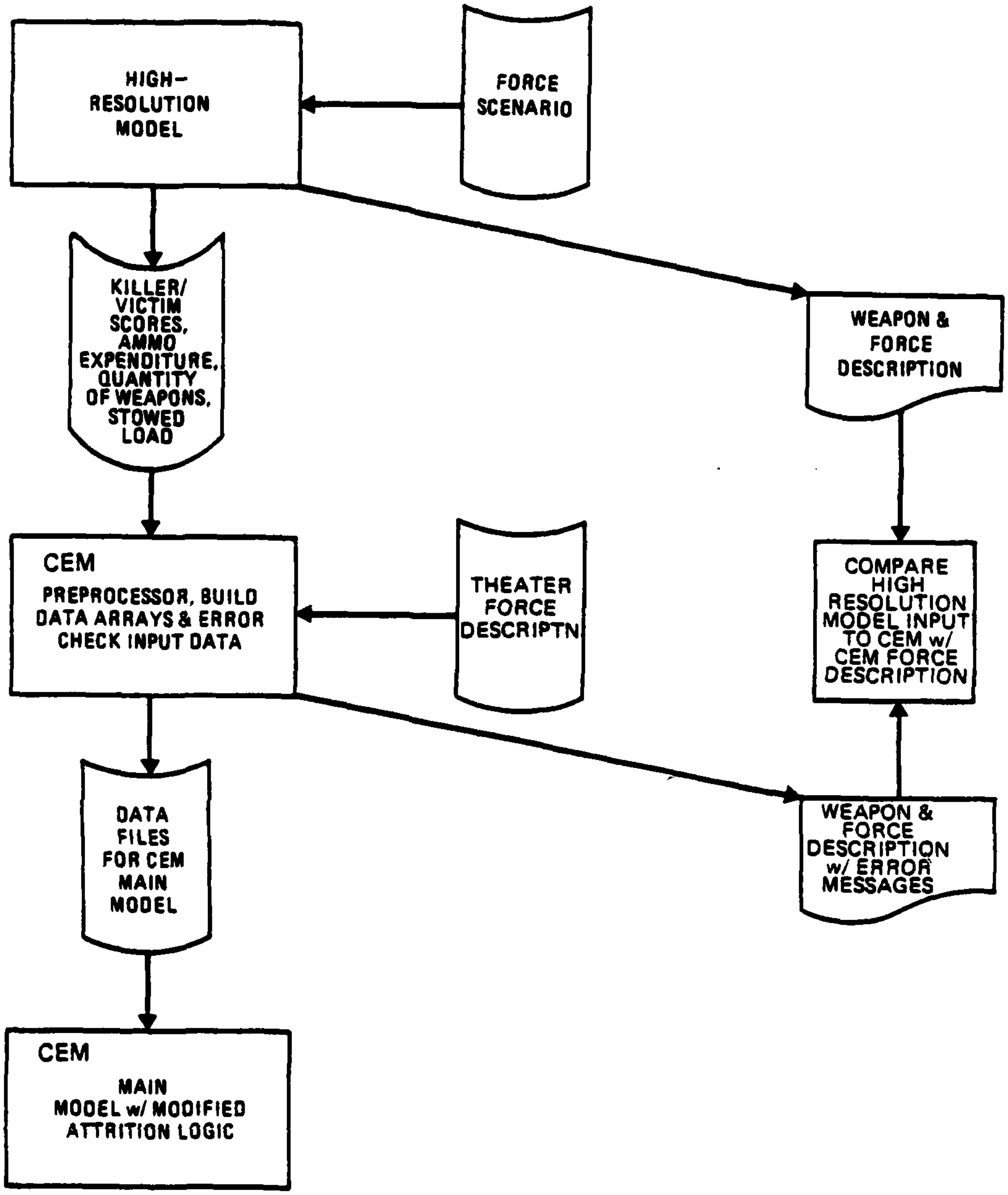

Figure 1. High-Resolution Model/CEM

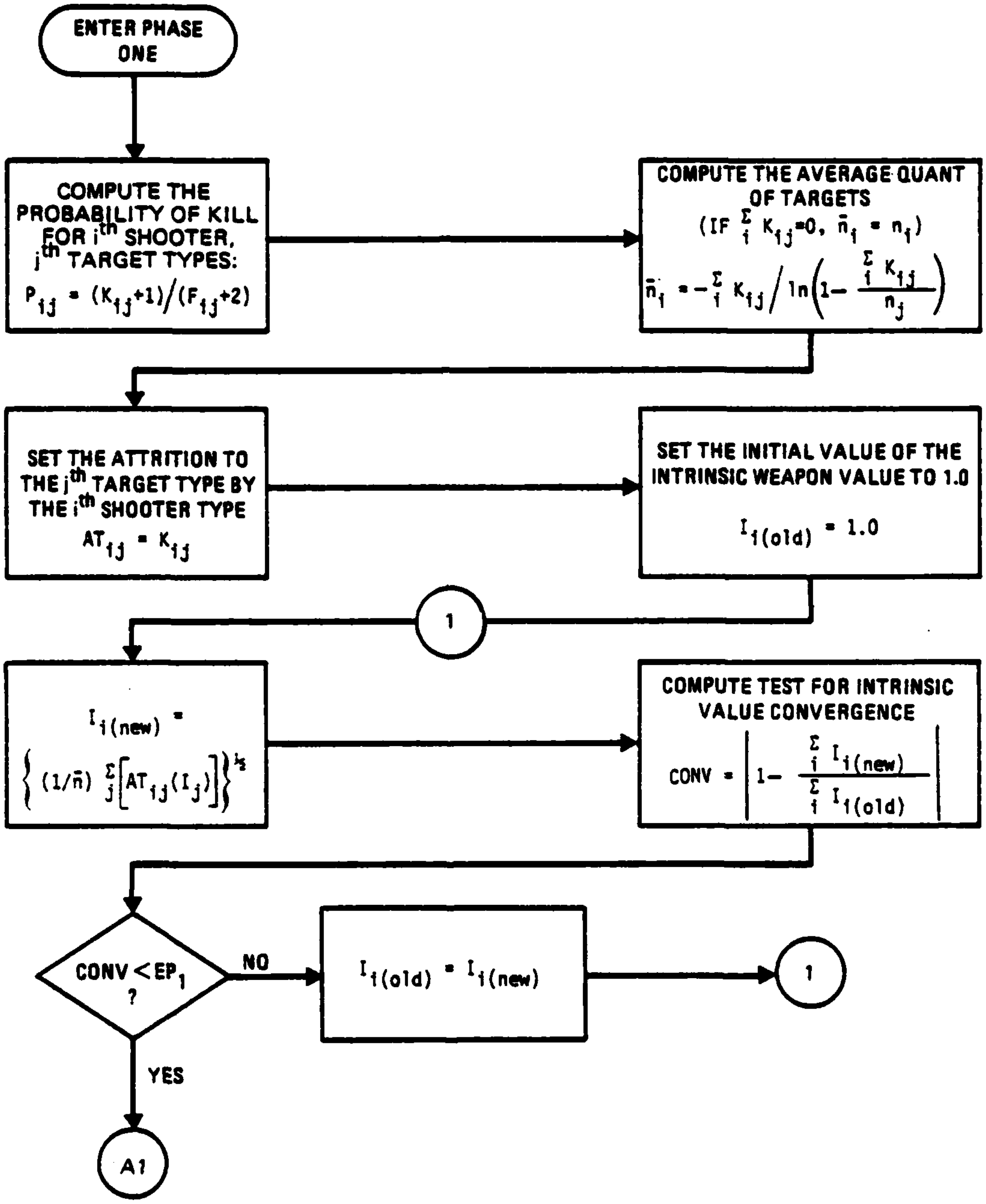

Figure 2. Phase I of Attrition Calibration Algorithm

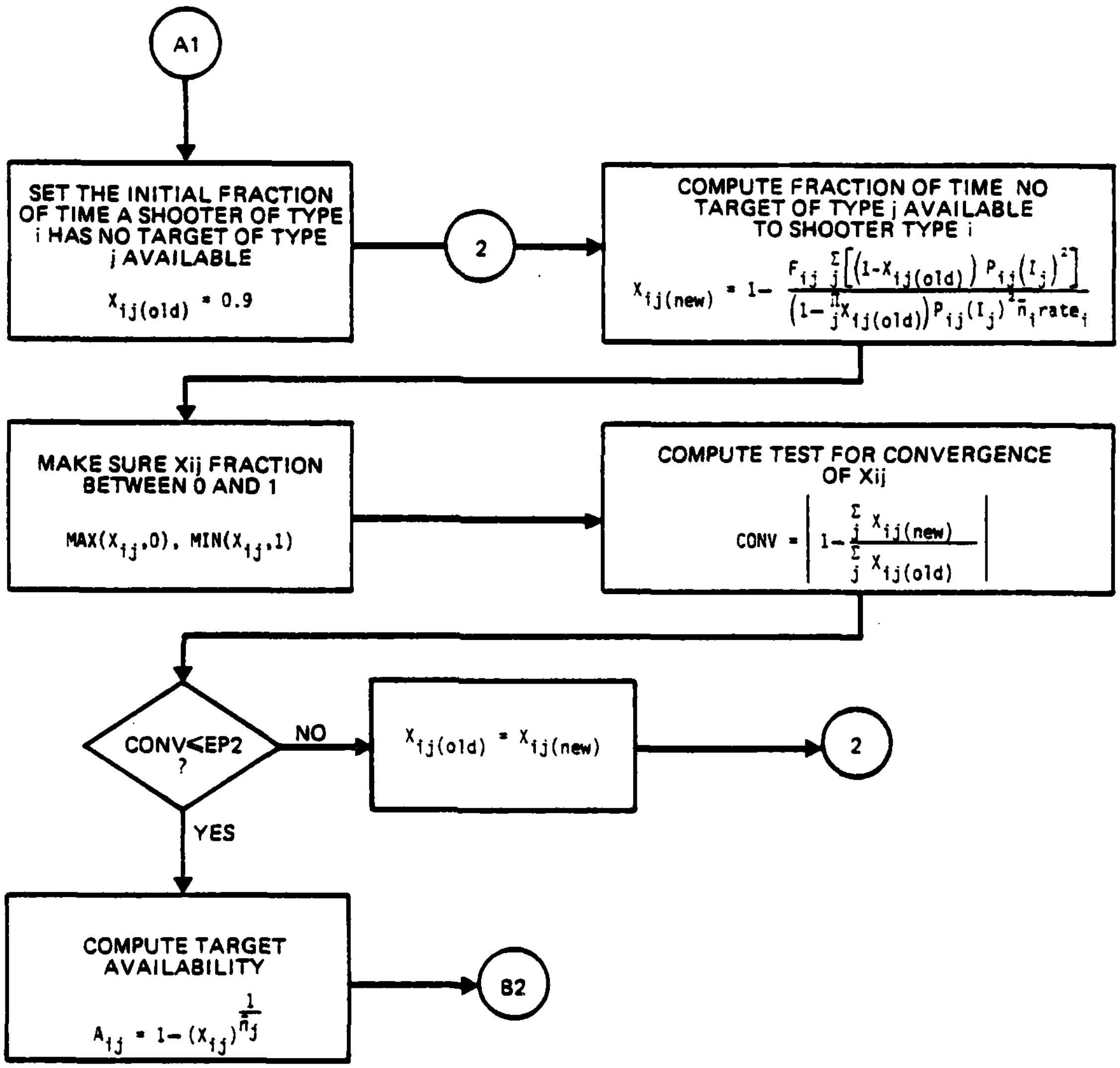

Figure 2. Phase I of Attrition Calibration Algorithm (Continued)

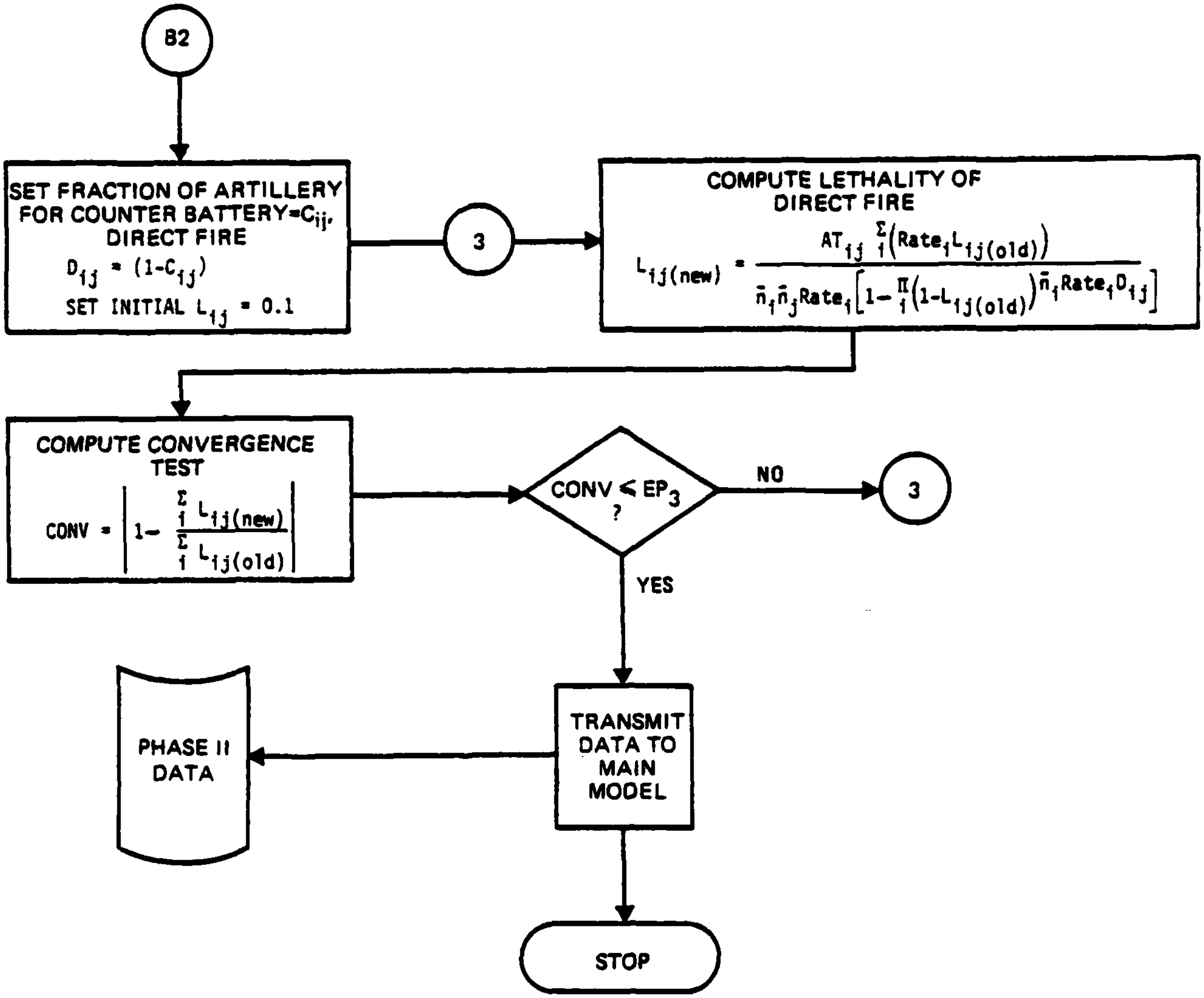

Figure 2. Phase I of Attrition Calibration Algorithm (Continued)

and other data (see Table 2 in the appendix) generated by the high resolution model, (2) compute a weapon's relative contribution (intrinsic value) to inflict enemy losses as a function of:

a. Target vulnerability
b. Target availability
c. Shooter availability
d. Target threat

and (3) compute that fraction of an assessment cycle a weapon is available as a target based on:

a. The quantity of rounds expended by the i^{th} type shooter against the j^{th} type target.

b. The probability of the i^{th} type shooter killing the j^{th} type target.

c. The quantity of the i^{th} type shooters.

d. The intrinsic value of the j^{th} type target to the i^{th} type shooter.

e. The rate of fire of the i^{th} type shooter against the j^{th} type target.

The flow diagram in Fig. 2 shows Phase I of this algorithm as it was tested using data generated by the high-resolution model CARMONETTE.[1] Referring to Fig. 2: the following data is required for Phase I:

K_{ij} = killer/victim scores of the i^{th} shooter type against the j^{th} target type.

F_{ij} = quantity of rounds fired by the i^{th} shooter type against the j^{th} target type.

N_i = quantity of shooters of type i.

Rate $_i$ = stowed ammo load by weapon type.

---

[1]Due to the unavailability of the division-level Combat Sampler Generator model (currently under development at CAA) results from the CARMONETTE model were used to generate the required killer/victim scores and other data.

The CEM is divided into three parts. The first part is the preprocessor, which reads the scenario input data and builds "packed" data arrays for the main model. The second part is the main model which simulates the theater combat; and the third part is the postprocessor, which generates the reports. As shown in Fig. 1, the preprocessor scans the input data for errors. It is therefore the logical place to scan the high-resolution model data, such as weapon type, for inconsistencies between the CEM weapon type descriptions and those used in the high resolution model. For example, if there are four types of tanks used in the high-resolution model and five types of tanks used in the CEM weapon description, an error exists. Additional error checking should include checking the probability of kill (P_{ij}), as generated in Phase I of this algorithm, to make sure none exceed 1.0. Phase II of this algorithm, which extrapolates the attrition to differing weapon mixes, should be executed in the CEM preprocessor with the weapon count equal to that used in the high-resolution model. Since the weapon count is equal to that used in the high-resolution model, the attrition, as computed by Phase II, should equal that generated by the high resolution model. If the results are not reasonably close (see Table 1 for an example), then additional checking of the high-resolution data is indicated.

The process of interface between the high resolution model and the CEM preprocessor must be computerized. The magnitude of data required for this proposed attrition calibration process would otherwise be unmanageable. For example, the maximum data requirement is: 50 weapon types on each side (50 types of killers times 50 types of victims = 2500) times the 8 possible engagement types times the 4 possible terrain types times the 2 types of data arrays required (killer/victim and rounds fired), yields

$$2500 \times 8 \times 4 \times 2 = 160{,}000 \text{ data items}$$

The output from the computation in Phase I, CEM preprocessor, is an array of target availabilities (A_{ij}). Recall that (A_{ij}) is that

TABLE 1

EQUAL FORCE ATTRITIONS

Weapon Type	CARMONETTE Attrition	Phase II Attrition
B_1	4.12	4.25
B_2	4.32	4.71
B_3	0	0.20
B_4	0.13	0.16
B_5	0	0.03
B_6	2.13	2.10
B_7	0.53	0.56
B_8	0	0
R_1	54.06	53.94
R_2	1.06	0.95
R_3	12.72	12.44
R_4	3.92	4.04
R_5	0	0
R_6	0	0

fraction of an accessment cycle for which the j^{th} type target is available to the i^{th} type shooter. This array along with other arrays such as the probability of kill (given a shot) of the i^{th} type shooter against the j^{th} target type (P_{ij}) and the ammo stowed load by weapon type i (rate $_i$) are "passed" from the CEM preprocessor to the CEM main combat model. The main combat model of the CEM then uses this data and Phase II of the attrition algorithm to compute battle attrition (based on variations in weapon mix as a function of each CEM engagement).

As shown later (Fig. 4), Phase II is an iterative solution of a series of equations. The first step is to compute the fire allocated (F_{ij}) by the i^{th} type shooter against the j^{th} type target. This computation is a function of:

1. That fraction of an assessment cycle (in the CEM this is 12 hours) for which the j^{th} type of target is available to the i^{th} type of shooter (A_{ij}).
2. The rate of fire for the i^{th} type of shooter (Rate $_i$).
3. The average quantity of the j^{th} type of target in the engagement ($\bar{n}_j$).
4. The probability that the i^{th} type of shooter kills, per round, the j^{th} type of target (P_{ij}).
5. The relative intrinsic weapon value (I_j). The first iteration of Phase II uses the (I_j) value as computed in Phase I of this algorithm. Each subsequent iteration of Phase II computations will use the (I_j) value computed during the previous iteration.

The second step is to compute the attrition to the j^{th} type of target by the i^{th} type of shooter (AT_{ij}). This is a function of the quantity of the i^{th} type shooters ($\bar{n}_i$) in the engagement times the number of rounds allocated by the i^{th} type shooter against the j^{th} type target (F_{ij}) times the probability of a kill (P_{ij}) per round. The third step is to compute

a "new" intrinsic value for each weapon (I_j) based on:

1. The quantity of the i^{th} type of shooters.
2. The attrition (AT_{ij}).
3. The intrinsic weapon value (I_j).

The iteration of these steps continues until the difference between the weapon attrition (AT_{ij}), as computed during the present iteration, does not significantly differ from that of the previous iteration, (i.e., the solution coverages). Experience, to date, has shown that 8 to 10 iterations are required to meet a convergence criterion of (0.01).

3.1 ESTIMATION AND ASSESSMENT MODIFICATIONS

In the current version of the CEM, each unit computes a measure of the strengths of his own forces and of those opposing him. A component of this measure is the unit's state, which represents the unit's present firepower divided by the unit's full TOE firepower. The unit's state is used as an indicator of the potential mission a unit may undertake. It is therefore an indicator of potential force value relative to a particular mission. To rid the CEM completely of firepower scores, research is needed to derive a "force value" that correlates with the new attrition process. However, for the time being some form of firepower scores must remain a part of the CEM to allow for the situation estimation.

For the battle assessment process the firepower scores can be deleted, insofar as the killer/victim score are available. The major break (modification) to the CEM is to void that portion of the assessment logic for which the proposed attrition algorithm, Phase II, can be substituted. As shown in Figs. 3, 4, and 5 this proposed attrition algorithm is a subroutine which, for the CEM's assessment logic, replaces the CEM subroutine MYOUT. As the subroutine MYOUT is currently shared by both the CEM's situation estimation and assessment, only that portion of MYOUT which deals with assessment is deleted. The subroutine MATSUM generates the firepower matrix for both the situation estimation and

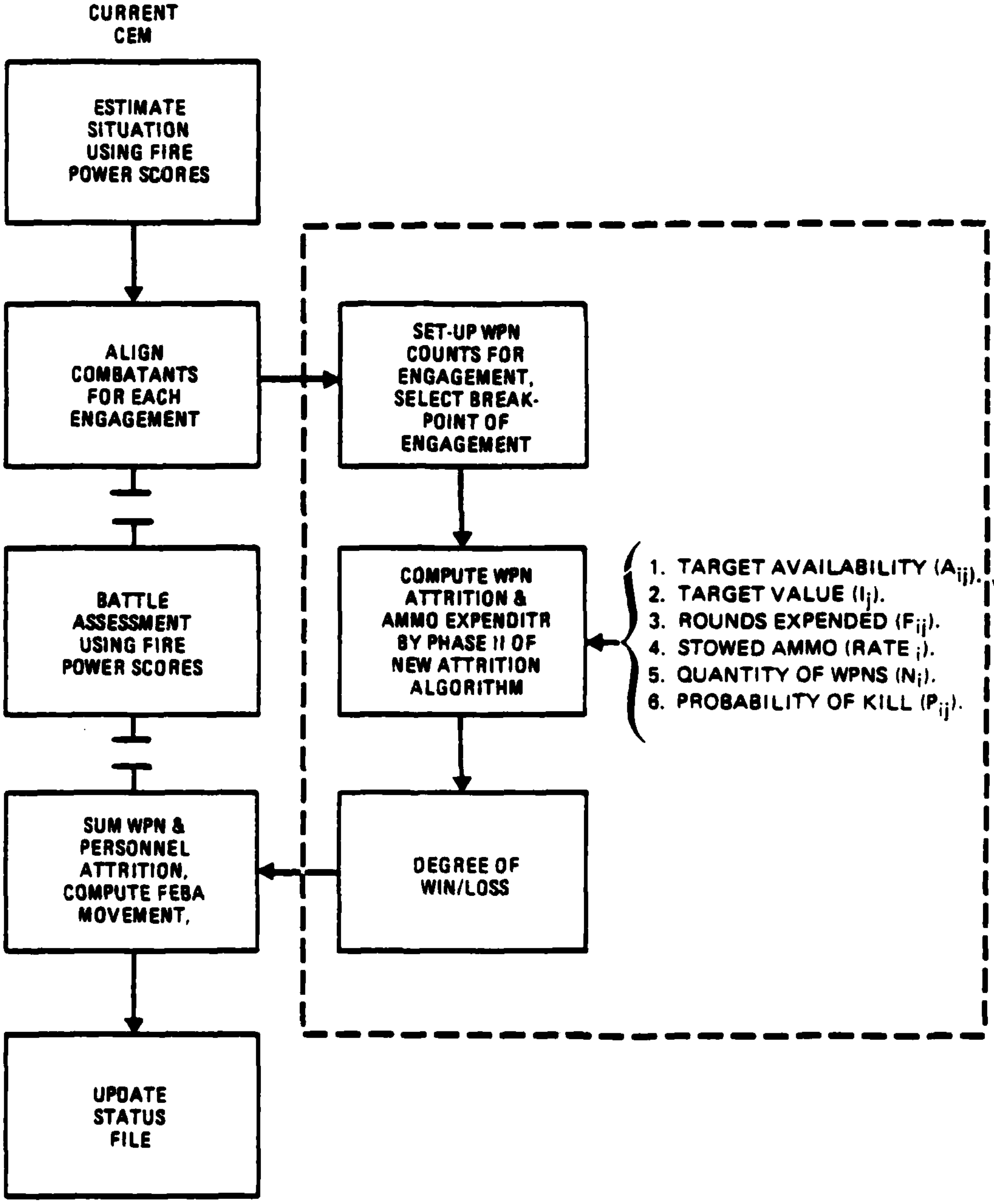

Figure 3. CEM Attrition Modifications

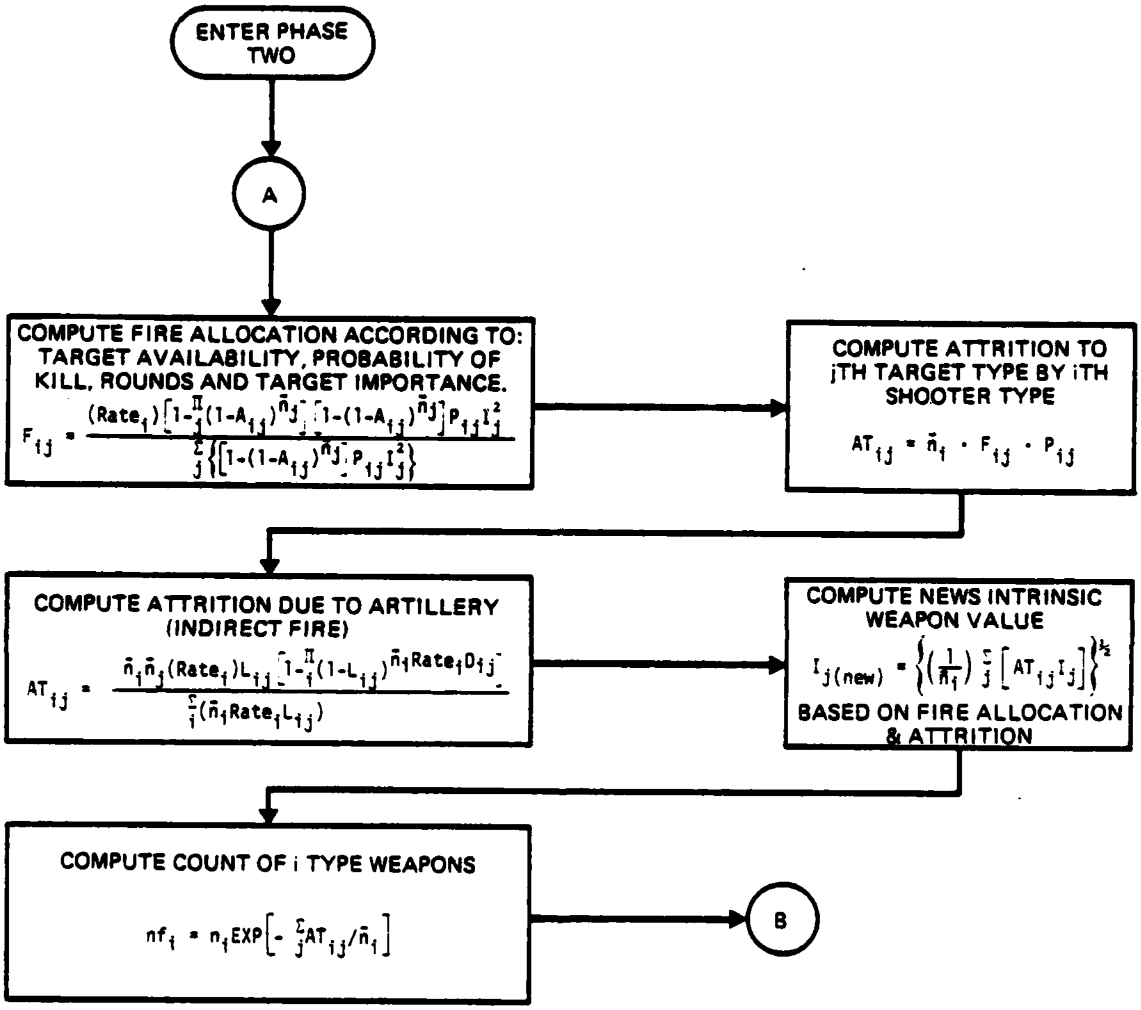

Figure 4. Phase II Attrition Algorithm

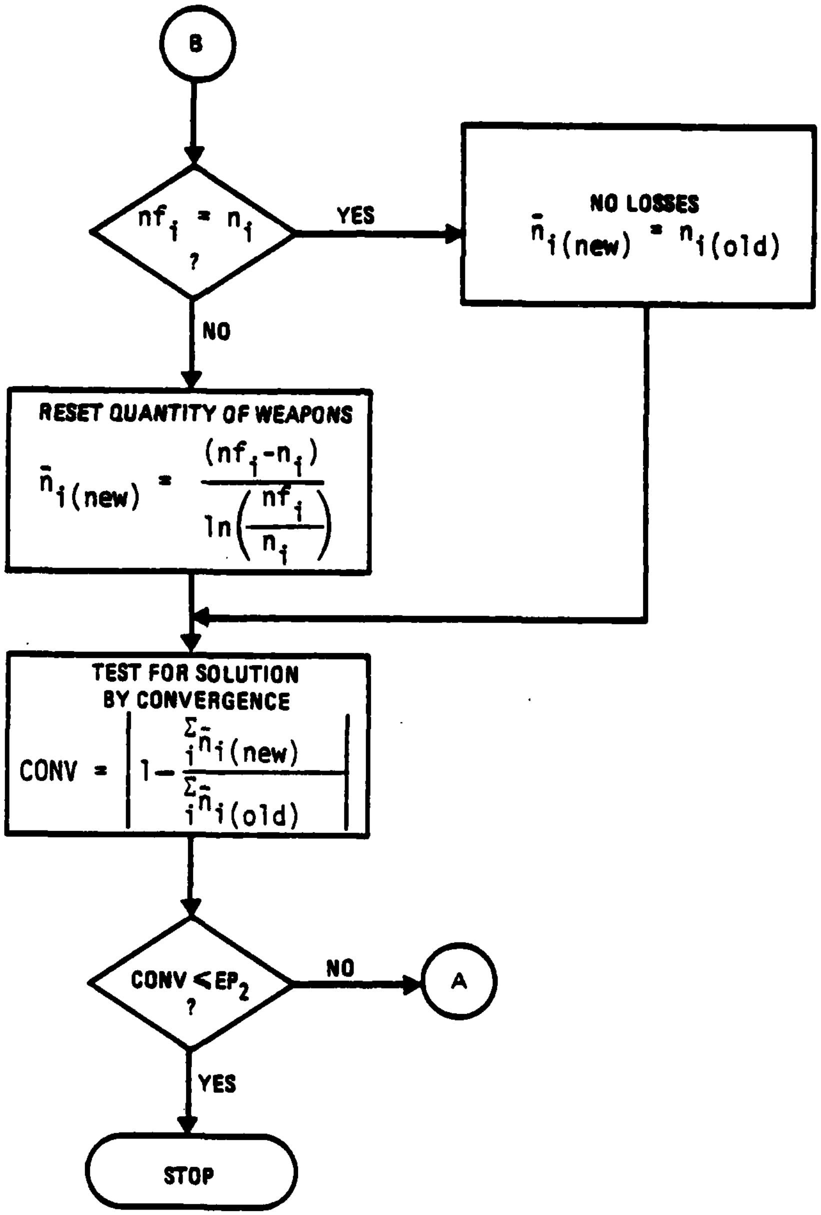

Figure 4. Phase II Attrition Algorithm (Cont.)

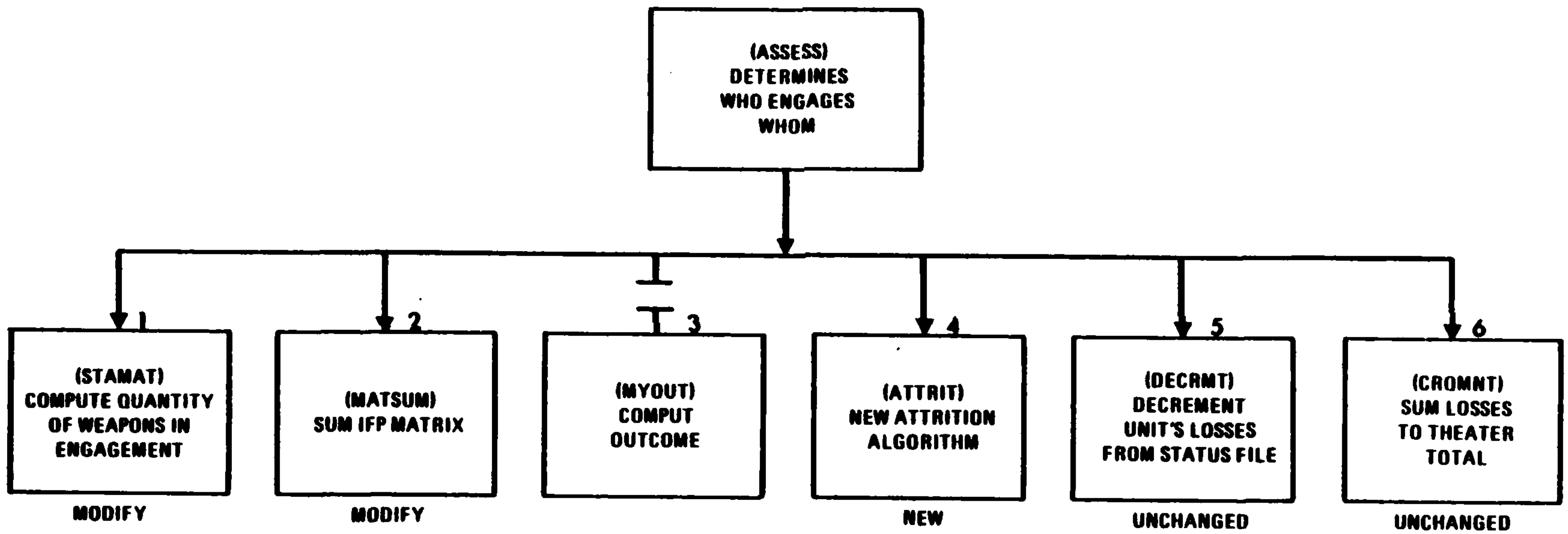

Figure 5. New CEM Attrition Logic

assessment. The assessment logic should be removed. This assessment logic, in both MYOUT and MATSUM, is identified by the switch KPRSW = 1 (KPRSW = 0 is for estimation). Note for those weapons such as CAS, for which there may not be killer/victim scores, the foregoing subroutines will continue to build that portion of the firepower matrix as required for battle assessment.

During the battle assessment logic a new subroutine (ATTRIT) is "called." ATTRIT, as shown in Figs. 3 and 5, will set up the weapon counts by type for each subsector engagement and modify the weapon counts according to the fraction of the unit engaged. Any constraints due to AMMO/POL/or OTHER supply shortages, as computed by the subroutine PQMOD, will reduce the quantity of weapons in the engagement. In the absence of killer/victim scores for the artillery and/or close air support, that portion of MATSUM which sums the firepower matrix into one such matrix must be duplicated in ATTRIT. That portion of the weapon description array (WPNBUF) which hold the firepower for each weapon type for each engagement type is deleted. Other portions of the battle assessment such as RESLOS (reserve unit losses) must, in the absence of killer/victim scores, continue to use the firepower scores for attrition.

The output of the subroutine (ATTRIT) is the attrition by weapon type. This replaces much of the present subroutine (CASL). Much of that portion of CASL which remains, calculations and bookkeeping of DNBI, KIA and other such operations, will have to be rewritten. The current subroutines (TNKAPC and HELOSS) can be voided with the exception of the repairable and abandonment computations. The remaining portion of these two subroutines which compute the repairable, etc., should be called by (ATTRITT). Since the ammo expenditures are computed by the new attrition algorithm, this computation is handled in the new subroutine ATTRIT. The subroutine DECRMT (decrements losses from unit's status file) and CRQMT (sums losses and resupply requirements across the entire theater) remain as they are.

3.2 BEHAVIORAL ANALYSIS

The results of six parametric variations (weapon counts) are shown in Figs. 6 and 7. The first test applied to the attrition algorithm was to determine if, given an array of killer/victim scores from the CARMONETTE model, Phase II would reproduce the same attrition results given the same weapon counts. As shown in Table 1, the attrition algorithm did reproduce the input data. The next series of parametric variations changed the quantity of all Red weapons from one-fourth to ten times the CARMONETTE inputs. In Figs. 6 (attrition) and 7 (ammo expenditure) the horizontal axis is the quantity of Red weapons as just described. In Fig. 6 the vertical axis is the total weapon attrition for the Red weapon R1) and the Blue weapon (B1). The attrition (Fig. 6) as calculated by the proposed attrition algorithm, shows all the Blue weapons of type 1 are killed when the Red weapon count is about three times the CARMONETTE inputs. Red attrition however, reaches a maximum when the weapon count is about 2.6 times the quantity used in the CARMONETTE run. As the Red force is increased beyond this point the Red attrition declines. The derivation of these numbers, in this case the CARMONETTE model, has built-in the target acquisition system (target availability A_{ij}), and an implied fire rate. As long as targets are available and weapons can engage them, increasing the quantity shooters on one side will increase the opposing side's attrition. In this example, as the Red force (quantity of weapons) increases, Blue is capable of attriting Red up to a point of saturating his (Blue's) target acquisition and firing systems; i.e., Blue's fire rate is fully committed; thus additional Red targets cannot be "serviced" by the Blue weapons. Red on the other hand, may engage Blue by multiple shooters per target. Under such conditions Blue's attrition is quick and complete. The faster Red can attrit the Blue shooters the more Red weapons survive. Figure 7 reinforces the foregoing by showing Blue's rounds (ammo) expended as "peaking" at about 125 rounds for the assessment cycle for all Blue type 1 weapons. As the

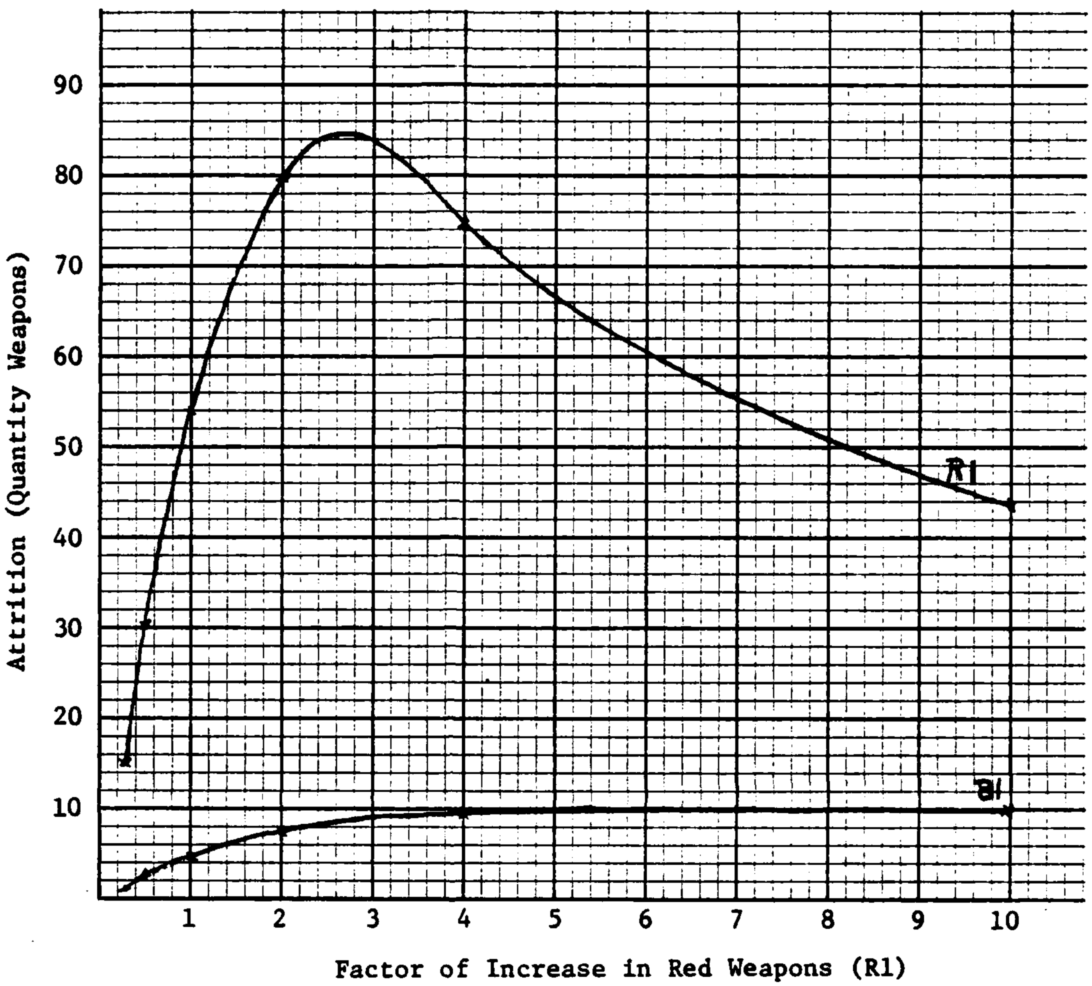

Figure 6. Factor of Increase in Red Weapons (R1)
With Respect to Attrition

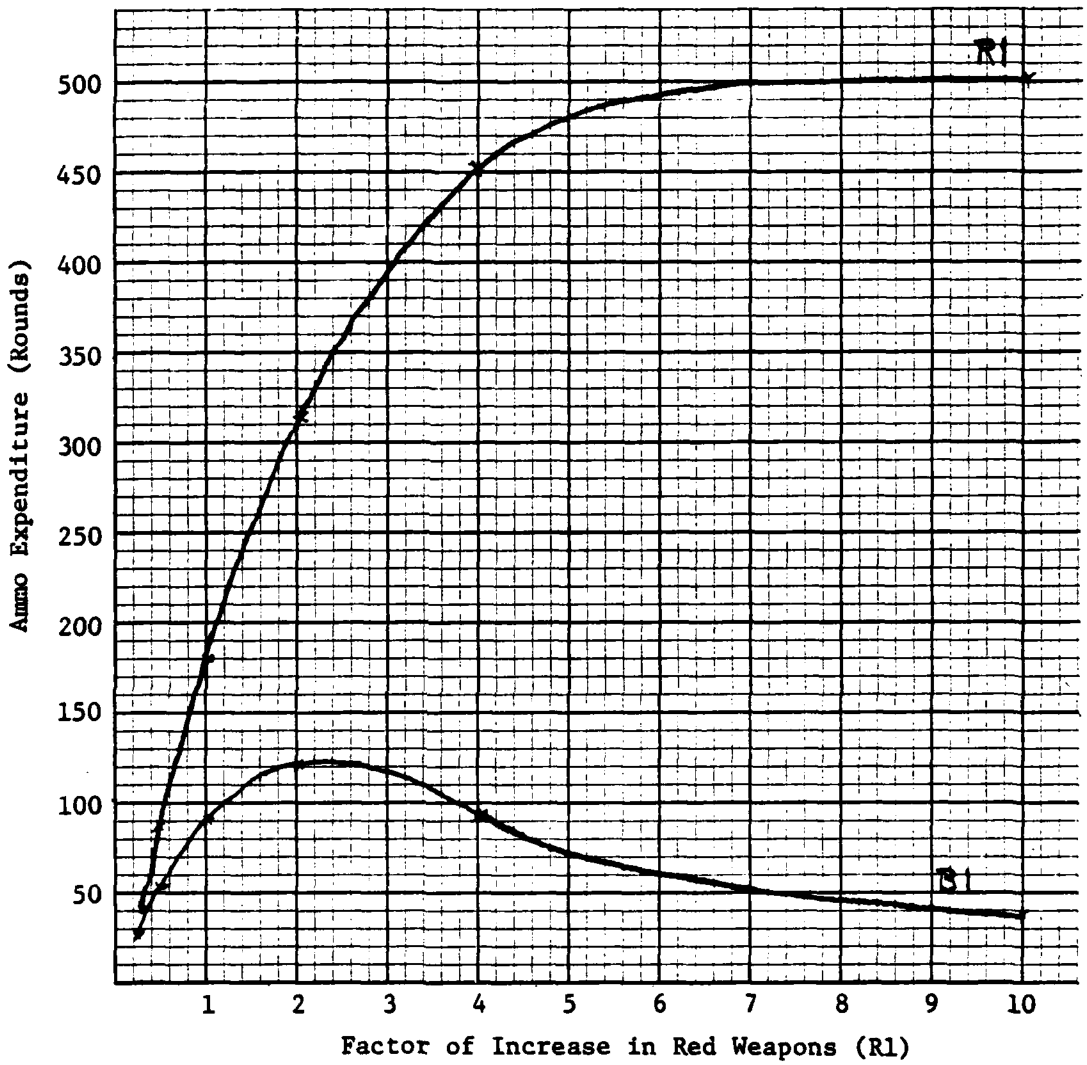

Figure 7. Factor of Increase in Red Weapons (R1)
With Respect to Ammunition

Red force increases, the quantity of rounds expended by the Blue type 1 weapons decreases; i.e., the shorter the life of the shooter (in this case Blue) the less rounds (ammo) expended.

One additional set of parametric variation runs were made to determine how well the attrition algorithm could reproduce CARMONETTE results. The results of three CARMONETTE runs, whose variations consisted of the quantity of Red tanks (20, 40, and 80)--all other weapon counts remained constant--was available. The attrition algorithm (Phase I) was calibrated to the killer/victim scores of the 80 Red tanks CARMONETTE run. Phase II of the attrition algorithm reproduced the same attrition quantities as CARMONETTE. However, as can be seen in Fig. 8, the attrition algorithm deviated somewhat from the CARMONETTE results when the 20 and 40 Red tank forces were computed. This variation in results supporting a requirement for continued parametric sensitivity examination. One possible explanation of the deviation in comparing results is shown in the "error bars" (Fig. 8). The variation in attrition, as generated by CARMONETTE for 15 replications of the same scenario, is significant enough to force the results of Phase II of the attrition algorithm to be somewhat low.

3.3 SUMMARY

Given that the data storage and computer central processor unit's (CPU) speed make such data storage requirements manageable, then the calibration of the CEM's attrition process to this new algorithm is viable. The proposed automated tie between the high-resolution model and the CEM preprocessor should alleviate most problems associated with manually handling the required data inputs. For the CEM, the only problem associated with the use of this attrition algorithm is the availability of data. For those targets for which the CEM currently assesses casualties, such as the reserve unit, for which there may not be killer/victim scores, either a new attrition methodology will have to be developed or the CEM will have to continue to use its present firepower scores.

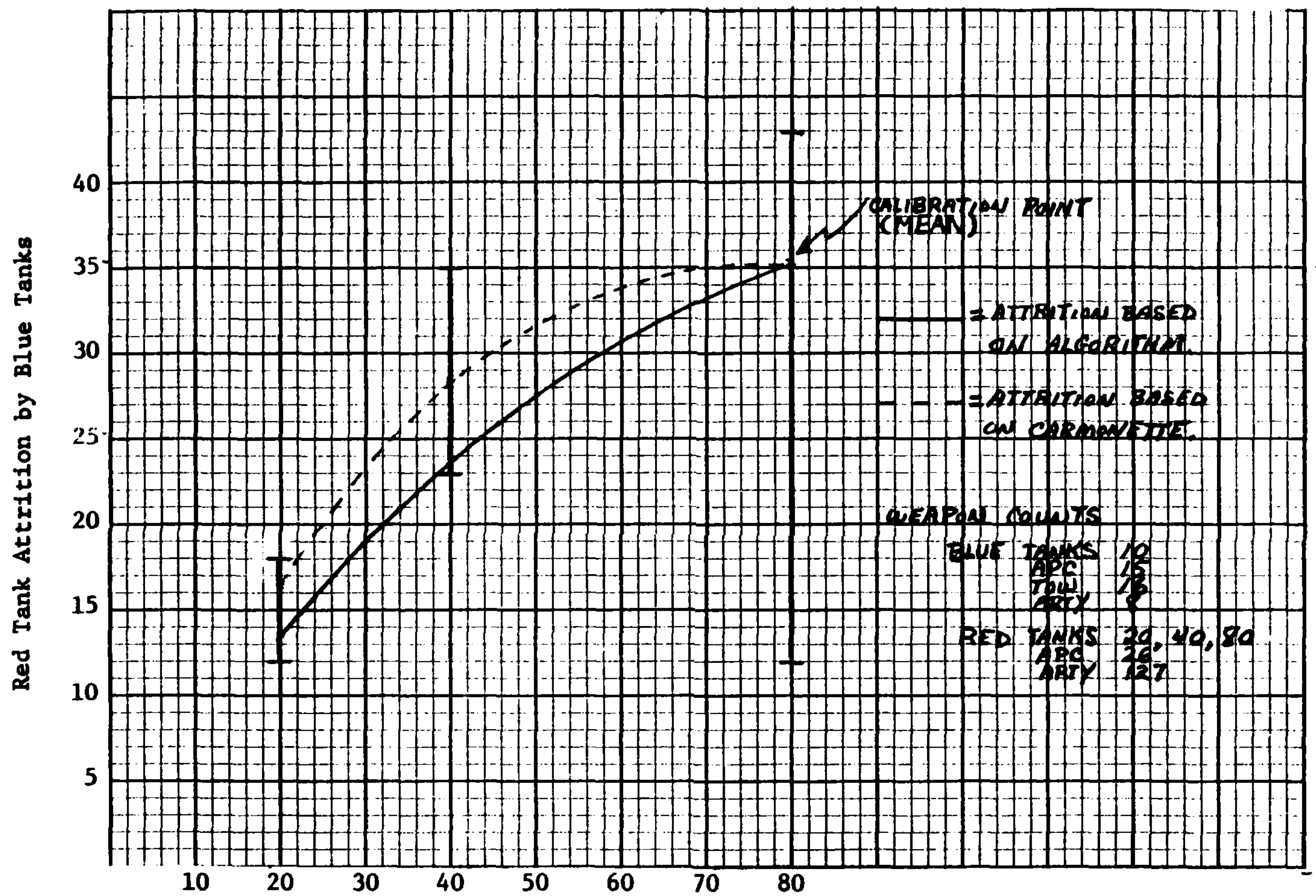

Figure 8. Quantity of Red Tanks in Scenario
(All Other Weapon Counts Held Constant)

4 FIXED FORTIFIED DEFENSIVE LINES SECTION II

During the Heavy/Light Study a need was recognized to expand the flexibility of the CEM to represent intermediate variations of fixed and mobile theater defense concepts. This section of this report is an outline of a proposed method (design) to include fixed fortifications at various locations on the battlefield.

Part of the Heavy/Light Study documentation[1] specified tnat the required programming changes to the CEM must include "phase lines." As proposed and coded there may be up to three phase lines per side. The location and length of each phase line is set by the user as part of the initial scenario data input.

It is proposed that any or all phase lines defined may have weapons co-located within, much as a division, brigade, or any other unit in CEM is currently defined; i.e., each phase line will have a status file. If the status file of a phase line has a zero balance then there are no weapons co-located in the phase line. Note: the presence or absence of weapons with a phase line does not preclude that phase line from being used as an event trigger for command and control.

Essentially, the phase line with fortifications works as follows. As the FEBA advances, it may encounter a phase line. If the phase line has fortifications the FEBA advance will stop at the phase line--regardless of the computed advance. That portion of the defender (assuming the phase line belongs to the defender's side) which is located at the phase line will augment its firepower by that fraction of the phase line touching the FEBA.

[1] Concepts Evaluation Model Modifications for Heavy/Light Forces Evaluation (CEMHL), General Research Corporation, 1068-01-79-CR, March 1979.

For example:

assume (a) Phase line length = 10 km
(b) Defender's FEBA touches 4 km of the phase line

then,

(Phase line weapon) x 4/10 = Augmentation firepower

Once a phase line is overrun by the attacker the weapons are abandoned. The personnel are absorbed by the defender up to its authorized level. Those remaining are rotated to the personnel pool for redistribution during the next theater cycle.

Variations as to when the defender's FEBA is "touching" a fortified phase can be a user input. For example, one might say that, when the FEBA is within 2 km[1] of a fortified phase line, the defender's firepower may be augmented by the fixed fortifications. During the Heavy/Light Study a subroutine (PHASER) was coded, for the CEM, to compute the distance to any or nearest phase line. This subroutine can be used to compute the proximity to the defender's phase line.

Losses and consummables are in proportion to the amount of weapon engaged from both the defender's and phase line fortification's status files.

There are several means in which one can modify the CEM to define a status file with any or all phase lines. The one proposed here is felt to require the least programming effort. Essentially, the first three (3) reinforcing divisions (what up to now have been called reinforcing divisions) can be used to define the phase line fortifications.

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[1] This ± 2 km in essence gives a fortified phase line a prepared depth by 4 km.

The CEM currently builds a status file for each such unit, both Blue and Red. There does not exist any logic within the CEM which would preclude these three reinforcing divisions from defining the status file for such fortified phase lines.

Modifications to the CEM preprocess should recognize that for each phase line specified (see Heavy/Light Study documentation[1]) the first, second and/or third reinforcing division specifications (status file) would belong to specified phase line(s).

The required main model (CEM) modifications must include the estimating, assessment, and resupply logic.

4.1 ESTIMATION

The entire estimation (ESTIMA, ESTIMC, and ESTIMD) process must be modified such that the friendly force can recognize and include the augmented firepower from a fortified phase line. The unit should be permitted to attack using this augmented firepower from the fortified phase line. However, once the FEBA advances beyond the 2 km, the augmented firepower from the fortified phase line should be withdrawn.

4.2 ASSESSMENT

Only minor modification to the assessment logic is required. The MATSUM and MYOUT subroutines should unpack the fortified phase line status file and add its firepower to that of the defender in the firepower matrix.

The FEBA computations can remain as they are. The fact that the fortified phase line is ±2 km from its location may mean that only a portion of this augmented firepower is available during the CEM 12-hour assessment cycle. One might rationalize that the firepower delivered during the early stage of the assessment cycle might

[1] Report 1068-01-79-CR, op.cit.

have some shock effect over the entire 12 hours. Therefore, the FEBA advance is not unreal even though the augmented firepower was available during 6 of the 12 hours.

As earlier stated, fortified defenses (phase lines) which are overrun by the attacker are assumed to have abandoned their weapons.

4.3 RESUPPLY

A fortified phase line unit will not compete with maneuver units for supply. As previously stated, if a fortified phase line is overrun its personnel will be absorbed by the maneuver unit having just abandoned it (up to the authorized level of personnel of the maneuver unit.)

Those personnel from the overrun fortified phase line not absorbed by the maneuver unit are rotated to the theater personnel pool for redistribution during the next theater cycle.

4.4 REPORT GENERATION

The impact of such fortified fixed defensive positions should produce a separate report on:

a. Relative contribution to augmenting a maneuver unit's firepower.

b. Attrition and consumables.

c. Personnel and weapon status at time of enemy overrun.

APPENDIX

FORTRAN PROGRAM LISTING OF ATTRITION ALGORITHM WITH PROGRAM VARIABLE DEFINITION

TABLE 2

ATTRITION ALGORITHM INPUT DATA

Variable Name	Currently in CEM	Source	Description/ Comments
NBV	Yes	Scenario	Quant. of Blue vehicle types
NBVDF	Yes	Scenario	Quant. of Blue direct fire vehicle types
NRV	Yes	Scenario	Quant. of Red Vehicle Types
NRVDF	Yes	Scenario	Quant. of Red direct fire vehicle types
NREPL	No	Calibration Model	Quant. of replications (may be one)
FCB	Yes	Scenario	Fraction of arty in counter-battery
EP1, EP2, EP3	No		EPSILON-Test for convergence
Rate	No	Calibration Model	Max rounds/assessment cycle (ij weapon)
VN	Yes	Scenario	Quant. of vehicles by type
F	No	Calibration Model	Quant. of rounds fired by type i at j
QK	No		Quant. of j^{th} kills by i^{th} type shooter

PHASE I OF ATTRITION PROGRAM

```
UNCLASSIFIED*24-ATRITT(1).FSI/COSAGE
          DIMENSION VN(20),MWV(20)   ,RATE(30),F(30,20),QK(30,20),NWT(20),
         1 RANGE(30),P(30,20),VNBR(20),AT(30,20),QWS(30),VAL(30)
         2 ,VV(20),VVP(20),IND(30,2),X(30,20),M137(20),A(30,20),D(20,20)
         3,IKZ(20),FCB(30),INX(20,5)
C **** VN(I)- INITIAL QUANTITY OF VEHICLES OF TYPE I
C **** MWV(I,J)- QUANITY OF FIRST,SECOND...FIFTH WEAPON TYPE ON VEHICLE I.
C **** RATE(L)- MAXIMUM RATE OF FIRE OF WEAPON SYSTEM L IN ROUNDS/
C ****   REPLICATION, WHERE WEAPONS SYSTEM IS A COMBINATION OF A GIVEN
C ****   WEAPON TYPE WITH A GIVEN VEHICLE TYPE.
C **** F(L,K)- QUANTITY OF ROUNDS FIRED BY WEAPON SYSTEM L AT VEHICLE
C **** TYPE K IN ALL REPLICATIONS.
C **** QK(L,K)- QUANTITY OF KILLS BY WEAPON SYSTEM L ON TARGET TYPE K.
C ****   IN ALL REPLICATIONS.
C **** QWS(L)- QUANTITY OF WEAPON TYPE L ON A VECHILE.
C **** AT(L,K) ATTRITION MATRIX BY WEAPON SYSTEM L AT TARGET TYPE K.
C **** VNBR(K)- AVERAGE QUANTITY OF VEHICLE OF TYPE K.
C **** VV(K)- STORE SUM OF VALUES TIMES NUMBER OF WEAPONS
C **** VVP(K)- STORE V(K) TIMES PROBABILITY
C **** IND(L,2)- STORE I,J INDEX ASSOCIATED WITH AN L.WEAPON INDEX
C **** X(L,K)- INDEX OF WEAPON L, AGAINST TARGET K.
C **** NBV- NUMBER OF TYPES OF BLUE VEHICLES.
C **** NBVDF- NUMBER OF TYPES OF DIRECT FIRE BLUE VEHICLES.
C **** NRV- NUMBER OF TYPES OF RED VEHICLES.
C **** NRVDF- NUMBER OF TYPES OF DIRECT FIRE RED VEHICLES.
C **** NBWS- NUMBER OF TYPES OF BLUE WEAPONS .
C **** NRWS- NUMBER OF TYPES OF RED WEAPONS.
C ****
C                                       ********
C
C
C
          DO 1 I=1,20
        1 IKZ(I)=1
          READ(5,501) NBV,NBVDF,NRV,NRVDF,NREPL
          WRITE(6,301) NBV,NBVDF,NRV,NRVDF,NREPL
          REPL=NREPL
      301 FORMAT('1',10X,'INITIAL INPUT VALUES'/10X,'NBV =',I3,'    NBVDF='
         1 ,I3,/10X,'NRV =',I3,'    NRVDF=',I3/10X,'REPLICATIONS  =',I3)
          NVT=NBV+NRV
          NBV1=NBV+1
          READ(5,502) (MWV(I),I=1,NVT)
          WRITE(6,7011) NVT,(MWV(I),I=1,NVT)
     7011 FORMAT (1H ,'TOTAL QUANT OF VEHICLE TYPES=',I4,/1H ,
         1'QUANT OF WEAPONS ON EACH VEHICLE TYPE',20I4,//)
          NBVDF1=NBVDF+1
          NVDF=NBVDF+NRVDF
          NBVA=NBV-NBVDF
          NRVA=NRV-NRVDF
          NVAT=NBVA+NRVA
          NBVA1=NBVA+1
          L=0
          KRDF=NBV+NRVDF
          DO 290 I=1,NVT
          JS=MWV(I)
          DO 288 J=1,JS
          L=L+1
```

PHASE I OF ATTRITION PROGRAM
(Continued)

```
      IND(L,1)=I
      IND(L,2)=J
      INX(I,J)=L
  288 CONTINUE
      IF(I.EQ.NBVDF)LBDF=L
      IF(I.EQ.NBV)NBWS=L
      IF(I.EQ.KRDF) LRDF=L
  290 CONTINUE
      NWST=L
      NRWS=NWST-NBWS
      LBDF1=LBDF+1
      NBWSA=NBWS-LBDF
      NBWSA1=NBWSA+1
       NRWSA=NWST-LRDF
       NWSA=NBWSA-NRWSA
      IF(NBVA.EQ.0) GO TO 851
C
C
      READ(5,505) (FCB(II),II=1,NBWSA )
  851 IF(NRVA.EQ.0) GO TO 852
      READ(5,505) (FCB(II),II=NBWSA1,NWSA)
  505 FORMAT(5F5.3)
  501 FORMAT(2I3)
  502 FORMAT(20I3)
  852 READ(5,504) CONX,CONXA
  504 FORMAT(10F5.0)
      LRDF1=LRDF+1
      READ(5,503) EP1,EP2 ,EP3
      NBWS1=NBWS+1
      READ(5,504) (RATE(L),L=1,NWST)
      READ(5,504)  (VN(L),L=1,NVT)
      READ(5,504) (QWS(L),L=1,NWST)
      WRITE (6,7012)
 7012 FORMAT (1H ,///,1H ,'MAX RATE OF FIRE BY WEAPON SYSTEM I=N',
     1'(IN ROUNDS PER ASSESSMENT CYCLE)')
C     IF(NBVA.EQ.0 .AND. NRVA.EQ.0 ) GO TO 854
C     WRITE(6,308) (IKZ(I),I=1,NBVA)
C     IF(NBVA.EQ.0) GO TO 853
C     DO 305 J=1,5
C 305 WRITE(6,307) J,(FCB(I,J),I=1,NBVA)
C 853 IF(NRVA.EQ.0) GO TO 854
C     DO 306 J=1,5
C 306 WRITE(6,307) (FCB(I,J),I=NBV1,NVT)
C 307 FORMAT(9X,I2,10X,10F5.3)
C 308 FORMAT(' '//20X,'FRACTION COUNTER BATTERY'/10X,'J',10X,10I5)
C
C
  854 WRITE(6,311) (RATE(L),L=1,NWST)
  311 FORMAT(//10X,'RATE(L)=',10F7.2/18X,10F7.2)
      WRITE (6,312) (VN(L),L=1,NVT)
  312 FORMAT (1H ,//1H ,'INITIAL QUANT OF VEHICLES BY TYPE'/,
     11H ,/1H ,'VN(L)  =',10F6.1/18X,10F6.1)
      WRITE(6,310) CONX,CONXA,EP1,EP2,EP3
  310 FORMAT(///20X,'INITIAL VALUE OF X FOR DIRECT FIRE',F6.2,'    ',
     1 'INITIAL VALUE OF X FOR ARTILLERY'F6.2 /20X,'EPSILON FOR VAL'
     2 ,F7.5,'   EPSILON FOR X OF DIRECT FIRE',F7.5,'   EPSILON FOR X'
     3 ,' OF ARTILLERY',F7.5)
```

PHASE I OF ATTRITION PROGRAM
(Continued)

```
  503 FORMAT(3F7.5)
      WRITE(6,320) (IKZ(K),K=NBV1,NVT)
  320 FORMAT('1',20X,'FIRING MATRIX,F, FOR DIRECT FIRE WEAPONS',
     1' (ROUNDS FIRED)'//25X,
     2'UPPER RIGHT PORTION'//10X,'SHOOTERS',18X,'TARGETS',/1H ,9X,
     3'L    I    J',4X,10I5,//)
      DO 7 L=1,LBDF
      I=IND(L,1)
      J=IND(L,2)
      READ(5,504) (F(L,K),K=NBV1,NVT)
    7 WRITE(6,321) L,I,J,(F(L,K),K=NBV1,NVT)
  321 FORMAT(6X,3I5,4X,10F5.0)
      WRITE(6,322)(IKZ(I),I=1,NBV)
  322 FORMAT(//25X,'LOWER LEFT PORTION OF F'//10X,'SHOOTERS',18X,
     1'TARGETS',/1H ,24X,10I5)
      DO 8 L=NBWS1,LRDF
      READ(5,504) (F(L,K),K=1,NBV)
    8 WRITE(6,321) L,IND(L,1),IND(L,2),(F(L,K),K=1,NBV)
      WRITE(6,323) (IKZ(I),I=NBV1,NVT)
  323 FORMAT('1',20X,'KILL MATRIX'//25X,'UPPER RIGHT PORTION OF K'//
     110X,'SHOOTERS',18X,'TARGETS',/1H ,24X,10I5)
C
C
      DO 9 L=1,NBRS
      READ(5,504) (QK(L,K),K=NBV1,NVT)
      I=IND(L,1)
      J=IND(L,2)
    9 WRITE(6,321) L,I,J,(QK(L,K),K=NBV1,NVT)
      WRITE(6,324) (IKZ(I),I=1,NBV)
  324 FORMAT(//25X,'LOWER PORTION OF K'//10X,'SHOOTERS',18X,'TARGETS',
     1/1H ,24X,10I5)
      DO 10 L=NBRS1,NRST
      READ(5,504) (QK(L,K),K=1,NBV)
   10 WRITE(6,321) L,IND(L,1),IND(L,2),(QK(L,K),K=1,NBV)
C
C                                                 **********
C                                                   1 P(IJK)
C
      DO 11 L=1,LBDF
      DO 11 K=NBV1,NVT
   11 P(L,K)=(QK(L,K)+1.)/(F(L,K)+2.)
      DO 12 L=NBRS1,LRDF
      DO 12 K=1,NBV
   12 P(L,K)=( QK(L,K)+1.)/(F(L,K)+2.)
C
C                                             ********
C                                                 2 VNBR(K)
C
      DO 15 K=1,NVT
      SUM=0.
      DO 14 L=1,NWST
   14 SUM=SUM+QK(L,K)
      IF(SUM.EQ.0.) GO TO 13
      DNX=LOG( 1.-SUM/(VN(K)*REPL) )
      VNBR(K)=-SUM/DNX/REPL
      GO TO 15
   13 VNBR(K)=VN(K)
```

PHASE I OF ATTRITION PROGRAM
(Continued)

```
   15 CONTINUE
      WRITE(6,901) (VNBR(K),K=1,NVT)
  901 FORMAT(/5X,'VNBR=',15F7.2)
C
C                                        *****
C                                        3 AT(IJK)
C
      DO 16 L=1,NWST
      CON=CONX
      IF((L.GT.LBOF.AND.L.LE.NBWS).OR.L.GT.LRDF) CON=CONXA
      DO 16 K=1,NVT
   16 X(L,K)=CON
      WRITE(6,371) (IKZ(K),K=NBV1,NVT)
  371 FORMAT('1',25X,'UPPER RIGHT OF MATRIX AT (ATTRITION)',
     1/9X,'SHOOTERS',18X,'TARGETS'/1H ,8X,'L      I      J',
     2 4X,12I6)
      DO 31 L=1,NBWS
      VAL(L)=1
      DO 30 K=NBV1,NVT
   30 AT(L,K)=QK(L,K)/REPL
  372 FORMAT(// 25X,'LOWER LEFT OF MATRIX AT (ATTRITION)',/9X,
     1'SHOOTERS',18X,'TARGETS',/1H ,8X,'L      I      J',
     2 4X,12I6)
   31 WRITE(6,333) L,IND(L,1),IND(L,2),(AT(L,K),K=NBV1,NVT)
  333 FORMAT(5X,3I5,5X,12F6.2)
      WRITE(6,372) (IKZ(K),K=1,NBV)
      DO 32 L=NBWS1,NWST
      VAL(L)=1.
      DO 33 K=1,NBV
   33 AT(L,K)=QK(L,K)/REPL
   32 WRITE(6,333) L,IND(L,1),IND(L,2),(AT(L,K),K=1,NBV)
C
C                                            *******
C                                            4 I(IJ)
C
      SUM=0.
      VNEW=NWST
C **** EFFECT OF ABOVE STATEMENT: SUM INITIALIZED VAL OF 1.
C
C
C     COMPUTE WEAPON TYPE INTRINSIC VALUE
C
      WRITE (6,7014)
 7014 FORMAT (//,1H ,25X,'COMPUTE WEAPON TYPE INTRINSIC VALUE')
      DO 50 NX=1,12
      VOLD=VNEW
      VNEW=0.
      DO 47 K =1,NVT
      SM=0.
      JS=NBV(K)
      IF(JS.EQ.0) GOTO 4611
      DO 46 J=1,JS
      LL=INX(K,J)
      SM=SM+ QWS(LL)*VAL(LL)**2
   46 CONTINUE
 4611 VV(K)=SM
   47 CONTINUE
```

PHASE I OF ATTRITION PROGRAM
(Continued)

```
            WRITE(6,7016) NX
     7016   FORMAT (5X,'ITERATION',I3)
            WRITE(6,903) (VV(K),K=1,NVT)
      903 FORMAT(5X,'VV =',10E12.4)
          DO 49 L=1,NWST
          SUM=0.
          DO 48 K=1,NVT
          IF((L.LE.NBWS.AND.K.LE.NBV).OR.(L.GT.NBWS.AND.K.GT.NBV)) GO TO 48
          SUM=SUM+AT(L,K)*VV(K)**.5
       48 CONTINUE
          I=IND(L,1)
          VAL(L)=(SUM/VNBR(I)/QWS(L))**.5
          VNEW=VNEW+VAL(L)
       49 CONTINUE
C                                            5
C
          IF(ABS(1.-VNEW/VOLD).LT.EPI) GO TO 60
       50 CONTINUE
          WRITE(6,601) VOLD,VNEW,EPI
          WRITE(6,339) (VAL(L),L=1,NWST)
      601 FORMAT('  PHASE 1 LOOP 1 DID NOT CONVERGE',3E14.6)
          STOP
       60 XOLD=0.
          WRITE(6,370)
          WRITE(6,339) (VAL(L),L=1,NWST)
      339 FORMAT(10X,'FINAL SOLUTION TO WEAPON TYPE INTRINSIC VALUE',
         1/10X,'VAL =',10F8.4)
C
C                                         *******
C                                          6 X(IJK)
C
          L85=1
          M85=LBDF
          K75=NBV1
          M75=NVT
          WRITE(6,330)
      330 FORMAT('1',25X,'X(L,K) MATRIX FOR DIRECT FIRE'//)
          DO 90 J90=1,2
          WRITE(6,375) (IKZ(K),K=K75,M75)
      375 FORMAT(8X,'L    I    J',5X,1218)
          DO 85 L=L85,M85
          DO 61 K=K75,M75
       61 XNEW=XNEW+X(L,K)
          DO 79 NXX=1,20
          XOLD=XNEW
          XNEW=0.
          SUM=0.
          PROD=1.
          DO 77 LL=K75,M75
          SUM=SUM+(1.-X(L,LL))*P(L,LL)*VV(LL)*VNBR(LL)/VN(LL)
       77 PROD=PROD*X(L,LL)
          DO 75 K=K75,M75
          I=IND(L,1)
          UP= F(L,K)*SUM
          DOWN=(1.-PROD)*P(L,K)*VV(K)*VNBR(I)*QWS(L)*RATE(L)*REPL
         1*VNBR(K)/VN(K)
          X(L,K)=1.-UP/DOWN
```

PHASE I OF ATTRITION PROGRAM
(Continued)

```
      XNEW=XNEW+X(L,K)
   75 CONTINUE
C
C
C                                              7
      IF(ABS(1.-XNEW/XOLD).LT.EP2) GO TO 84
   79 CONTINUE
      WRITE(6,609) L,(X(L,KK),KK=1,NVT)
  609 FORMAT(' X DOES NOT CONVERGE FOR WEAPON',I4/10F8.3/10F8.3)
      STOP
   84 WRITE(6,331) L,IND(L,1),IND(L,2),NXX,(X(L,K),K=K75,M75)
   85 CONTINUE
  331 FORMAT(5X,3I4,T28,I3,T22,12F8.4)
      L85=NBWS1
      M85=LRDF
      K75=1
      M75=NBV
      WRITE(6,370)
   90 CONTINUE
  370 FORMAT(/)
      WRITE (6,7018)
 7018 FORMAT ('1',14X,'A V A I L A B I L I T Y',/1H ,10X,
     1'FRACTION OF ASSESSMENT CYCLE TARGET IS AVAILABLE TO SHOOTER')
C
C                                            ******
C                                              8
C
      DO 103 L=1,LBDF
      DO 101 K=1,NBV
  101 A(L,K)=0.
      DO 102 K=NBV1,NVT
  102 A(L,K)=1.-X(L,K)**(1./VNBR(K))
  103 CONTINUE
      WRITE(6,620) (IKZ(I400),I400=NBV1,NVT)
  620 FORMAT(1H ,20X,'UPPER RIGHT MATRIX A'/14X,'K=',10(6X,I4))
      WRITE(6,623)
      DO 401 L=1,LBDF
      WRITE(6,621)   L,IND(L,1),IND(L,2), (A(L,K),K=NBV1,NVT)
  401 CONTINUE
  621 FORMAT(5X,3I4,10E10.4)
      DO 106 L=NBWS1,LRDF
      DO 104 K=1,NBV
  104 A(L,K)=1.-X(L,K)**(1./VNBR(K))
  106 CONTINUE
      WRITE(6,622) (IKZ(I400),I400=1,NBV)
  622 FORMAT(' '// 21X,'LOWER LEFT MATRIX A'/14X,'K=',10(6X,I4))
      WRITE(6,623)
  623 FORMAT(8X,'L    I    J')
      DO 402 L=NBWS1,LRDF
      WRITE(6,621) L,IND(L,1),IND(L,2),(A(L,K),K=1,NBV)
  402 CONTINUE
C
C                                           *******
C                                             8.A
C
      KRDF1=KRDF+1
      NRWSA=NWST-LRDF
```

```
      NBWSA=NBWS-LBDF
      NBWSA1=NBWSA+1
      NWSA=NBWSA+NRWSA
      IF(NBWSA.EQ.0) GO TO 113
      DO 112 LL=1,NBWSA
      DO 108 K=NBV1,KRDF
  108 D(LL,K)=1.-FCB(LL)
      DO 109 K=1,NBV
  109 D(LL,K)=0.
      DO 110 K=KRDF1,NVT
  110 D(LL,K)=FCB(LL)
  112 CONTINUE
  113 IF(LRDF1.GT.NWST) GO TO 128
      DO 124 LL=NBWSA1,NWSA
      DO 121 K=NBV1,NVT
  121 D(LL,K)=0.
      DO 122 K=1,NBVDF
  122 D(LL,K)=1.-FCB(LL)
      DO 123 K=NBVDF1,NBV
  123 D(LL,K)=FCB(LL)
  124 CONTINUE
      WRITE(6,335)
  335 FORMAT(// 25X,'L MATRIX ARTILLERY (LETHALITY)',//)
  128 IF(NBWSA.EQ.0.AND.NRWSA.EQ.0) GO TO 142
C
C                                        *******
C                                        L(IJK)
C
      DO 139 K=1,NVT
      IF(K.GT.NBV) GO TO 130
      L134=LRDF1
      LS=NBWSA
      N134=NWST
      XLNEW=NWST-LRDF
      GO TO 131
  130 L134=LBDF1
      N134=NBWS
      LS=0
      XLNEW=NBWS-LBDF
  131 XLNEW=XLNEW*CONXA
      K1350=0
      K1355=0
      DO 137 L137=1,20
      XLOLD=XLNEW
      XLNEW=0.
      DO 134 L=L134,N134
      PROD=1.
      SUM=0.
      LQ=LS
      DO 132 LL=L134,N134
      I=IND(LL,1)
      LQ=LQ+1
      SUM=SUM+RATE(LL)*QWS(LL)*X(LL,K)
      PROD=PROD*(1.-X(LL,K))**(VNBR(I)*RATE(LL)*QWS(LL)*D(LQ,K))
  132 CONTINUE
      X(L,K)=AT(L,K)*SUM/(VNBR(K)*RATE(L)*QWS(L)*(1.-PROD))
      IF(X(L,K).GT.1.) GO TO 1350
```

```
      IF(X(L,K).LT.0.) GO TO 1355
      GO TO 1360
 1350 X(L,K)=1.
      K1350=K1350+1
      GO TO 1360
 1355 X(L,K)=0.
      K1355=K1355+1
 1360 XLNEW=X(L,K)+XLNEW
  134 CONTINUE
      IF(XLNEW.EQ.0.) GO TO 138
      IF(ABS(1.-XLOLD/XLNEW).LT.EP3) GOTO138
C                                        10
C
      WRITE(6,6025) K,(X(L,K),L=L134,N134)
 6025 FORMAT(3X,I5,3X,8E15.5)
  137 CONTINUE
      IF(K.LE.NBV) WRITE(6,612) K,(X(L,K),L=LRDF1,NWST)
      IF(K.GT.NBV) WRITE(6,612) K,(X(L,K),L=LBDF1,NBWS)
  612 FORMAT(' X ARTILLERY DOES NOT CONVERGE K =',I4/10X,10F8.3)
      STOP
  138 M137(K)=L137
      DO 140 L=L134,N134
  140 A(L,K)=X(L,K)
      WRITE(6,6009) K,M137(K),K1350,K1355
 6009 FORMAT(10X,4I6)
  139 CONTINUE
      WRITE(6,7018)
C
C                                      .......
C                                        11
C
      WRITE(6,620) (IKZ(I400),I400=NBV1,NVT)
      WRITE(6,623)
      DO 405 L=1,NBWS
      WRITE(6,621)  L,IND(L,1),IND(L,2), (A(L,K),K=NBV1,NVT)
  405 CONTINUE
      WRITE(6,622) (IKZ(I400),I400=1,NBV)
      WRITE(6,623)
      DO 406 L=NBWS1,NWST
      WRITE(6,621) L,IND(L,1),IND(L,2),(A(L,K),K=1,NBV)
  406 CONTINUE
      GO TO 1400
  142 WRITE(6,345)
  345 FORMAT(10X,'NO ARTILLERY')
 1400 WRITE(14) NRV,NBVDF,NBV1,NBVDF1,NBWS,NBWS1,NRV,NRVDF,NVT,
     1 NWSA,NWST,LRDF,LRDF1,LBDF,LBDF1
      WRITE(14)((IND(L,J),L=1,NWST),J=1,2)
      WRITE(14)((P(L,K),K=1,NVT),L=1,NWST)
      WRITE(14)((A(L,K),K=1,NVT),L=1,NWST)
      IF(NWSA.EQ.0) GO TO 1430
      WRITE(14)((D(L,K),K=1,NVT),L=1,NWSA)
 1430 WRITE(14) (RATE(L),L=1,NWST)
      WRITE(14)((INX(I,J),I=1,NVT),J=1,5)
      WRITE(14) (QWS(L),L=1,NWST)
      WRITE(14) (MWV(K),K=1,NVT)
      STOP
      END
```

PHASE II OF ATTRITION PROGRAM

```
UNCLASSIFIED*24-ATRITT(1).FS3/V1
                 SUBROUTINE MAT(REC,M,N,NA,L1,L2,L3,K1,K2,K3,IND,J,JJ)
                 DIMENSION REC(M,N),IND(30,2),IKZ(20),NA(17)
                 DO 1 MQ1=1,20
               1 IKZ(MQ1)=MQ1
                 IF(J.EQ.1) WRITE(6,600)
             600 FORMAT('1')
             601 FORMAT('0',20X,'MATRIX    ',20A4)
             602 FORMAT('0',25X,'UPPER RIGHT PORTION  (BLUE VS. RED)'    )
             603 FORMAT(2X,3I4,5X,12F8.3)
             604 FORMAT('0',25X,'LOWER LEFT PORTION  (RED VS. BLUE)')
             606 FORMAT(5X,'L',3X,'I',3X,'J',5X,12I8)
                 WRITE(6,601) NA
                 IF(JJ.EQ.0) GOTO 22
                 WRITE(6,602)
                 WRITE(6,606)  (IKZ(K),K=K2,K3)
                 DO 10 L=1,L1
                 WRITE(6,603) L,IND(L,1),IND(L,2),(REC(L,K),K=K2,K3)
              10 CONTINUE
                 WRITE(6,604)
                 WRITE(6,606) (IKZ(K),K=1,K1)
                 DO 20 L=L2,L3
                 WRITE(6,603) L,IND(L,1),IND(L,2),(REC(L,K),K=1,K1)
              20 CONTINUE
                 RETURN
              22 WRITE(6,602)
                 WRITE(6,654) (IKZ(K),K=K2,K3)
                 DO 30 L=1,L1
                 WRITE(6,653) L,IND(L,1),IND(L,2),(REC(L,K),K=K2,K3)
              30 CONTINUE
                 WRITE(6,604)
                 WRITE(6,654) (IKZ(K),K=1,K1)
                 DO 40 L=L2,L3
                 WRITE(6,653) L,IND(L,1),IND(L,2),(REC(L,K),K=1,K1)
              40 CONTINUE
             653 FORMAT(2X,3I4,5X,12E9.3)
             654 FORMAT(5X,'L',3X,'I',3X,'J',12I9)
                 RETURN
                 END

@BRKPT PRINTS
```

```
UNCLASSIFIED*24-ATRITT(1).FS27/V1
          DIMENSION IND(30,2),INX(20,5),A(30,20),D(20,20),P(30,20),
         1 RATE(30),QWS(30),VV(20),VAL(30),IK2(20),AP(30,20),AT(30,20),
         2 F(30,20),RANGE(30),VN(30),VNBR(30),FN(20),IT(30),MVW(30),VNB(20)
          DIMENSION COLOR(2),LB1(17),LB2(17),LB3(17),LB4(17),LB5(17)
         1,LB6(17),LB7(17),LB8(17),LB9(17),LB10(17)
          DATA  COLOR/'BLUE','RED '/
          READ(5,579)  LB1,LB2,LB3,LB4,LB5,LB6,LB7,LB8,LB9,LB10
      579 FORMAT(17A4)
          READ(14) NBV,NBVDF,NBV1,NBVDF1,NBWS,NBWS1,NRV,NRVDF,NVT,
         1 NWSA,NWST,LRDF,LRDF1,LBDF,LBDF1
          WRITE(6,610) NBV,NRV,NBVDF,NRVDF
      610 FORMAT('1',20X,'PHASE 2',10X,'INPUTS'//10X,'NUMBER OF BLUE VEHICL'
         1,'ES',12X,I4,10X,'NUMBER OF RED VEHICLES',12X,I4//10X,'NUMBFR OF '
         2,'DIRECT FIRE BLUE VEHICLES',I4,10X,'NUMBER OF DIRECT FIRE RED VE'
         3 ,'HICLES',I4)
          READ(14)  ((IND(L,J),L=1,NWST),J=1,2)
          READ(14) ( (P(L,K),K=1,NVT),L=1,NWST)
          CALL MAT(P,30,20,LB1,NBWS,NBWS1,NWST,NBV,NBV1,NVT,IND,0,1)
          READ(14) ( (A(L,K),K=1,NVT),L=1,NWST)
          CALL MAT(A,30,20,LB2,NBWS,NBWS1,NWST,NBV,NBV1,NVT,IND,1,0)
          IF(NWSA.EQ.0) GO TO 4
          READ(14) ((D(L,K),K=1,NVT),L=1,NWSA)
          NBA=NBWS-LBDF
          NBA1=NBA+1
          CALL MAT(D,20,20,LB3,NBA,NBA1,NWSA,  NBV,NBV1,NVT,IND,1,1)
        4 READ(14) (RATE(L),L=1,NWST)
          READ(14) ((INX(I,J),I=1,NVT),J=1,5)
          READ(14) (QWS(L),L=1,NWST)
          READ(14) (MVW(K),K=1,NVT)
          READ(5,501) W1D,Z,REP
      501 FORMAT(7F9.4)
          READ(5,502) (RANGE(L),L=1,NWST)
          READ(5,503) EPS,MXZ
          WRITE(6,698) EPS
      698 FORMAT(//10X,'EPS =',F9.5)
      503 FORMAT(F8.5,I3)
      502 FORMAT(10F5.0)
          READ(5,502)  (VN(K),K=1,NVT)
          WRITE(6,611) (RATE(L),L=1,NBWS)
          WRITE(6,612) (RATE(L),L=NBWS1,NWST)
          WRITE(6,613) (RANGE(L),L=1,NBWS)
          WRITE(6,614) (RANGE(L),L=NBWS1,NWST)
      611 FORMAT('0',10X,'RATE OF FIRE BLUE',2X,15F6.1)
      612 FORMAT(' ',10X,'RATE OF FIRE RED ',2X,15F6.1)
      613 FORMAT('0',10X,'RANGE FOR BLUE',5X,15F6.1)
      614 FORMAT(' ',10X,'RANGE FOR RED ',5X,15F6.1)
          WRITE(6,615)
          DO 60 K=1,NBV
          WRITE(6,616) K,MVW(K),VN(K),COLOR(1)
       60 CONTINUE
          DO 61 K=NBV1,NVT
          WRITE(6,616) K,MVW(K),VN(K),COLOR(2)
       61 CONTINUE
      616 FORMAT(17X,I2,19X,I3,16X,F6.1,10X,A4)
      615 FORMAT('0',10X,'VEHICLE K',5X,'WEAPON TYPES',5X,'NUMBER OF '
         1,'VEHICLES')
```

```
      DO 10 L=1,NWST
   10 VAL(L)=1.
      DO 11 K=1,NVT
   11 VNBR(K)=VN(K)
      DO 90 L=1,LROF
      IF(L.GT.LBDF.AND. L.LE.NBWS) GO TO 90
      ROW=RANGE(L)/WID
      DO 89 K=1,NVT
      IF(L.LE.LBDF.AND.K.LE.NBV) GO TO 89
      IF(L.GT.NBWS.AND.K.GT.NBV) GOTO 90
      IF(ROW.LT.1) GO TO 86
      AP(L,K)=A(L,K)
      GOTO 89
   86 AP(L,K)=A(L,K)*ROW
   89 CONTINUE
   90 CONTINUE
      JUMP=0
      DO 93 K=1,NVT
   93 VNB(K)=VN(K)
      CALL MAT(AP,30,20,LB4,NBWS,NBWS1,NWST,NBV,NAV1,P,T,IND,1,0)
      VNEW=NVT
      DO 275 NX=1,15
      VOLD=VNEW
      VNEW=0.
      DO 65 K=1,NVT
      JX=MVR(K)
      SMX=0
      DO 62 J=1,JX
      LX=INX(K,J)
      SMX=SMX+QWS(LX)*VAL(LX)*VAL(LX)
   62 CONTINUE
   65 VV(K)=SMX
      WRITE(6,650) (VV(K),K=1,NVT)
  650 FORMAT('0   ','VV(K) =',10E12.4/9X,10E12.4)
      IF(JUMP.EQ.1) GO TO 290
      DO 200 L=1,NWST
  106 L=WC
      LOOK=1
      IF(L.GT.LBDF.AND.L.LE.NBWS) GO TO 125
      IF(L.GT.LROF) GOTO126
      LOOK=0
      K120=1
      N120=NBV
      IF(L.GT.NBWS) GO TO 112
      K120=NBV1
      N120=NVT
  112 DO 120 K=K120,N120
      PROD=1.
      SUM=0.
      DO 115  LL=K120,N120
      PROD=PROD*(1.-AP(L,LL))**VNBR(LL)
      SUM=SUM+(1.-(1.-AP(L,LL))**VNBR(LL))*P(L,LL)*VV(LL)*VNBR(LL)/VN(LL)
     1)
  115 CONTINUE
      UP=REP*RATE(L)*(1.-PROD)*(1.-(1.-AP(L,K))**VNBR(K))*P(L,K)*VV(K)
     1 *VNBR(K)/VN(K)
      F(L,K)=UP/SUM
```

```
          I=IND(L,1)
          AT(L,K)=VNBR(I)*QWS(L)*F(L,K)*P(L,K)
      120 CONTINUE
          GO TO 145
      125 L135=LBOF1
          M135=NBWS
          K120=NBV1
          N120=NVT
          LS=0
          GO TO 128
      126 L135=LROF1
          M135=NWST
          LS=NBWS-LBOF
          K120=1
          N120=NBV
      128 I=IND(L,1)
          DO 140 K=K120,N120
          LQ=LS
          PROD=1.
          SUM=0.
          DO 135 LF=L135,M135
          IF=IND(LF,1)
          LQ=LQ+1
          PROD=PROD*(1.-A(LF,K))**(VNBR(IF)*RATE(LF)*QWS(LF)*REP*D(LQ,K)*Z/
         1BTOT)
          SUM=SUM+VNBR(IF)*RATE(LF)*QWS(LF)*A(LF,K)
      135 CONTINUE
          AT(L,K)=VNBR(I)*VNBR(K)*RATE(L)*QWS(L)*A(L,K)*(1.-PROD)/SUM
      140 CONTINUE
      145 SUM=0.
          I=IND(L,1)
          DO 150 K=K120,N120
          SUM=SUM+AT(L,K)*VV(K)**.5
      150 CONTINUE
          VAL(L)=(SUM/VNBR(I)/QWS(L))**.5
          VNEW=VNEW+VAL(L)
      200 CONTINUE
          DO 250 K=1,NVT
          IF(K.LE.NBV) GOTO 230
          L240=1
          M240=NBWS
          GO TO 233
      230 L240=NBWS1
          M240=NWST
      233 SUM=0.
          DO 240 LL=L240,M240
      240 SUM= AT(LL,K)+SUM
          IF(SUM.LE. 0.) GO TO 242
          FN(K)=VN(K)*EXP(-SUM/VNBR(K))
          VNBR(K)=(FN(K)-VN(K))/LOG(FN(K)/VN(K))
          GO TO 250
      242 FN(K)=VN(K)
          VNBR(K)=VN(K)
      250 CONTINUE
          IF(MX2.GT.NX)GO TO 260
          IF(ABS(1.-VNEW/VOLD).GT.EPS) GO TO 260
          JUMP=1
```

PHASE II OF ATTRITION PROGRAM (Continued)

```
 260 DO 265 K=1,NVT
     VNBR(K)=.5*(VNBR(K)+VNB(K))
 265 VNB(K)=VNBR(K)
     WRITE(6,697) (VNBR(K),K=1,NVT)
 697 FORMAT(5X,'N-BAR(K) =',10F7.2)
 275 CONTINUE
     WRITE(6,601) VNEW,VOLD,EPS
 601 FORMAT(' LOOP DOES NOT CONVERGE', 3E14.5)
 290 WRITE(6,602)
 602 FORMAT('1',50X,'** RESULTS **'//20X,'VEHICLE RESULTS',50X,'WEAPON
    1WORTHS'// 10X,'I',9X,'N(I)',7X,'FN(I)' ,4X,'N-BAR',8X,'I**2',1X,
    2 '(N-BAR)I**2',3X,'FORCE SUM',16X,'I(I)**2'//)
 607 FORMAT(63X,E12.4)
     SUM=0.
     DO 299 I=1,NVT
     VNVAL=VNBR(I)*VV(I)
     SUM=SUM+VNVAL
     WRITE(6,604) I, VN(I),FN(I),VNBR(I),VV(I),VNVAL
     JS=NVW(I)
     DO 296 J=1,JS
     L=INX(I,J)
     VALS=VAL(L)**2
     IF(J.GT.1) GO TO 295
     WRITE(6,605)   VALS,L
     GO TO 296
 295 WRITE(6,606) VALS,L
 296 CONTINUE
     IF(I.NE.NBV) GO TO 299
     WRITE(6,607) SUM
     SUM=0.
 604 FORMAT(7X,I4,F8.1,E12.4,F9.2,2E12.4)
 605 FORMAT('+',88X,E12.4  ,15X,I5)
 606 FORMAT(' ',88X,E12.4  ,15X,I5)
 299 CONTINUE
     WRITE(6,607) SUM
     CALL MAT(AT,30,20,LBS,NBWS,NBWS1,NWST,NBV,NBV1,NVT,IND,1,1)
     DO 303 K=NBV1,NVT
     SUM=0.
     DO 301 L=1,NBWS
 301 SUM=SUM+AT(L,K)
     FRK= AMIN1(SUM,VN(K))/SUM
     DO 302 L=1,NBWS
 302 F(L,K)=AT(L,K)*FRK
 303 CONTINUE
     DO 306 K=1,NBV
     SUM=0.
     DO 304 L=NBWS1,NWST
 304 SUM=SUM+AT(L,K)
     FRK=AMIN1(SUM,VN(K))/SUM
     DO 305 L=NBWS1,NWST
 305 F(L,K)=AT(L,K)*FRK
 306 CONTINUE
     DO 307 K=NBV1,NVT
     DO 307 L=1,NBVDF
     F(L,K)=F(L,K)/P(L,K)
 307 P(L,K)=F(L,K)/VN(K)
     DO 308 K=1,NBV
```

PHASE II OF ATTRITION PROGRAM (Continued)

```
      DO 308 L=NBWS1,LRDF
      F(L,K)=F(L,K)/P(L,K)
  308 P(L,K)=F(L,K)/VN(K)
      CALL MAT(F,30,20,LB7,LBDF,NBWS1,LRDF,NBV,NBV1,NVT,IND,1,1)
      DO 311 L=1,LBDF
      SUM=0.
      DO 310 K=NBV1,NVT
  310 SUM=SUM+F(L,K)
  311 QWS(L)=SUM
      DO 313 L=NBWS1,LRDF
      SUM=0.
      DO 312 K=1,NBV
  312 SUM=SUM+F(L,K)
  313 QWS(L)=SUM
      WRITE(6,608)
  608 FORMAT('1',40X,'AMMUNITION EXPENDITURE FOR DIRECT FIRE WEAPONS'//)
      DO 320 LL=1,LBDF
  320 WRITE(6,609) LL,QWS(LL),COLOR(1),IND(LL,1),IND(LL,2)
      DO 321 LL=NBWS1,LRDF
  321 WRITE(6,609) LL,QWS(LL),COLOR(2),IND(LL,1),IND(LL,2)
  609 FORMAT(10X,I4,E14.4,4X,A4,80X,2I3)
      STOP
      END
```

PHASE I INPUT DATA FROM CARMONETTE

```
UNCLASSIFIED=24-ATRITT(1).INFS1/VX1
  1      8   7                                              Quantity of Blue vehicle types (NBV, NBVDF).
  2      6   5                                              Quantity of Red vehicle types (NRV, NRVDF).
  3     15                                                  Quantity of CARMONETTE Repl (NREPL).
  4      1   2   1   1   1   1   1   4   4   1   1   1   1   5   Quantity of weapon system on vehicle type.
  5    .00                                                  Fraction of arty in counterbattery fire.
  6    .00
  7    .90   .01
  8    .01C00 .00010 .01000                                 EP1, EP2, EP3 convergence threshold.
  9    33.   41.    7.    2.   12.    3.   80.   12.  1.9  1.2   Stowed ammo load by weapon type
 10     .4   2.4   20.   10.   26.   84.    5.    4.   16.  12.    (Rate i)
 11    6.5  20.5  24.7  20.1   7.2
 12    10.   15.    8.    5.    8.    4.    3.   35.   80.   6.   Quantity of weapon from CARMONETTE run (VN)
 13    20.    6.    4.  140.
 14     1.    .6    1.    1.    1.    1.    1.    1.  .69  .11   Quantity of weapons of type "L" on
 15    .09   .11    1.    1.    1.    1.    1.    1.    1.   1.    vehicle (QWS)
 16    .02   .49   .36   .01   .12
 17  1331.   15.   27.    0.    0.    0.                    Quantity of rounds fired by weapon type i
 18     0.    5.  131.    0.    0.    0.                    at target type j, direct fire (F(ij))
 19   275.    6.   47.   11.    0.    0.                    Blue shooter.
 20    96.    0.    3.    0.    0.    0.
 21   249.   11.   93.    0.    0.    0.
 22     .0    .0    .0   42.    0.    0.
 23     0.    0.    0. 1367.    0.    0.
 24   159.    5.   59.    0.    0.    0.
 25  1524.    5.    0.    0.    0.    0.    0.    0.        F(ij) Red shooter.
 26     0. 1046.    2.    0.    0.    0.    0.    0.
 27     0.   14.    9.    0.    0.    0.    0.    0.
 28     0.    0.    0.    0.    2.    0.    0.    0.
 29    12.   12.    2.    2.    0.    0.    2.    0.
 30    15.   44.    2.    0.    0.    0.    0.    0.
 31    30.   32.    5.    0.    0.   72.    0.    0.
 32     0.    0.    0.   60.    0.    0.  243.    0.
 33   368.    0.    8.    0.    0.    0.                    Quantity of jth type targets
 34     0.    2.   23.    0.    0.    0.                    killed by ith shooters
 35   123.    3.   30.    0.    0.    0.                    QK(i,j) Blue shooter
 36    15.    0.    3.    0.    0.    0.
 37   182.    8.   72.    0.    0.    0.
 38     0.    0.    0.    6.    0.    0.
 39     0.    0.    0.   53.    0.    0.
 40   114.    3.   48.    0.    0.    0.
 41     6.    0.    5.    0.    0.    0.
 42     0.    0.    0.    0.    0.    0.
 43     0.    0.    0.    0.    0.    0.
 44     3.    0.    2.    0.    0.    0.
 45    39.    0.    0.    0.    0.    0.    0.    0.        QK(ij) Red Shooter
 46     0.   11.    0.    0.    0.    0.    0.    0.
 47     0.    0.    0.    0.    0.    0.    0.    0.
 48     0.    0.    0.    0.    0.    0.    0.    0.
 49     3.    3.    0.    2.    0.    0.    2.    0.
 50     5.    9.    0.    0.    0.    0.    0.    0.
 51     9.   11.    0.    0.    0.   27.    0.    0.
 52     0.    0.    0.    0.    0.    0.    6.    0.
 53     0.    2.    0.    0.    0.    0.    0.    0.
 54     2.   14.    0.    0.    0.    2.    0.    0.
 55     2.   12.    0.    0.    0.    3.    0.    0.
 56     2.    3.    0.    0.    0.    0.    0.    0.
 57     0.    3.    0.    0.    0.    0.    0.    0.
```

PHASE II INPUT DATA

```
UNCLASSIFILD*24-ATRITT(1).INFS2/VX)
  1       P  (PROBABILITY OF KILL GIVEN A SHOT,DIRECT FIRE ONLY)    Report Headings
  2       A  (INDIRECT FIRE LETHALITIES)
  3       D  (COUNTERBATTERY ALLOCATION OF ARTILLEY)
  4       AP  (SCALED AVAILABILITY FOR DIRECT FIRE)
  5       AT  ( ATTRITION)
  6       OF WEAPON VEHICLE ATTRITION
  7       OF ROUNDS FIRED PER WEAPON TYPE
  8       OF ROUNDS FIRED PER WEAPON
  9      BLANKS
 10      BLANKS
 11        1.0000   1.0000   1.0000
 12       3.0  2.8  3.7  1.5 10.0  3.0  4.5 10.0   .0   .0         Range of weapon
 13       0.0   .0  3.0  3.0  1.1  1.2  5.0  5.0  10.  6.5
 14       0.0  0.0  0.0  0.0  0.0
 15       .01000  8
 16       10.  15.   8.   5.   8.   4.   3.  35.  80.   6.         Quantity of vehicles for Phase II
 17       20.   6.   4. 198.
```

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM

```
          INITIAL INPUT VALUES
          NBV =  8   NBVDF=  7
          NRV =  6   NRVDF=  5
          REPLICATIONS  = 15
TOTAL QUANT OF VEHICLE TYPES=  14
QUANT OF WEAPONS ON EACH VEHICLE TYPE   1   2   1   1   1   1   1   4   4   1   1   1   1   5


MAX RATE OF FIRE BY WEAPON SYSTEM I-N(IN ROUNDS PER ASSESSMENT CYCLE)

          RATE(L)=  33.00  41.00   7.00   2.00  12.00   3.00  80.00  12.00   1.40   1.20
                      .40   2.40  20.00  10.00  26.00  84.00   5.00   4.00  16.00  12.0C

          RATE(L)=   6.50  20.50  24.70  20.10   7.20

INITIAL QUANT OF VEHICLES BY TYPE

VN(L)  =  10.0  15.0   8.0   5.0   8.C   4.0   3.0  35.0  80.0   6.0
                20.0   6.0   4.0 148.0

                INITIAL VALUE OF X FOR DIRECT FIRE   .90   INITIAL VALUE OF X FOR ARTILLERY   .01
                EPSILON FOR VAL .01030   EPSILON FOR X OF DIRECT FIRE .00010   EPSILON FOR X OF ARTILLERY .01000
```

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

FIRING MATRIX,F, FOR DIRECT FIRE WEAPONS (ROUNDS FIRED)

UPPER RIGHT PORTION

SHOOTERS			TARGETS					
L	I	J	9	10	11	12	13	14
1	1	1	1331.	15.	27.	0.	0.	C.
2	2	1	0.	5.	131.	0.	0.	0.
3	2	2	275.	6.	47.	11.	0.	0.
4	3	1	96.	0.	3.	0.	0.	0.
5	4	1	249.	11.	93.	0.	0.	0.
6	5	1	0.	0.	0.	42.	0.	0.
7	6	1	0.	0.	0.	1367.	0.	0.
8	7	1	159.	5.	59.	0.	0.	0.

LOWER LEFT PORTION OF F

SHOOTERS			TARGETS							
			1	2	3	4	5	6	7	8
13	9	1	1524.	5.	0.	0.	0.	C.	0.	0.
14	9	2	0.	1046.	2.	0.	0.	0.	0.	0.
15	9	3	0.	14.	9.	0.	0.	0.	0.	0.
16	9	4	0.	0.	0.	0.	2.	0.	0.	0.
17	10	1	12.	12.	2.	2.	0.	0.	2.	C.
18	11	1	15.	44.	2.	0.	0.	0.	0.	0.
19	12	1	30.	32.	5.	0.	0.	72.	0.	0.
20	13	1	0.	0.	0.	60.	0.	0.	243.	0.

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

KILL MATRIX

UPPER RIGHT PORTION OF K

SHOOTERS			TARGETS 9	10	11	12	13	14
1	1	1	360.	0.	8.	0.	0.	0.
2	2	1	0.	2.	23.	0.	0.	0.
3	2	2	123.	3.	30.	0.	0.	0.
4	3	1	15.	0.	3.	0.	0.	0.
5	4	1	182.	0.	72.	0.	0.	0.
6	5	1	0.	0.	0.	6.	0.	0.
7	6	1	0.	0.	0.	53.	0.	0.
8	7	1	114.	3.	48.	0.	0.	0.
9	8	1	6.	0.	5.	0.	0.	0.
10	8	2	0.	0.	0.	0.	0.	0.
11	8	3	0.	0.	0.	0.	0.	0.
12	8	4	3.	0.	2.	0.	0.	0.

LOWER PORTION OF K

SHOOTERS			TARGETS 1	2	3	4	5	6	7	8
13	9	1	39.	0.	0.	0.	0.	0.	0.	0.
14	9	2	0.	11.	0.	0.	0.	0.	0.	0.
15	9	3	0.	0.	0.	0.	0.	0.	0.	0.
16	9	4	0.	0.	0.	0.	0.	0.	0.	0.
17	10	1	3.	3.	0.	2.	0.	0.	2.	0.
18	11	1	5.	9.	0.	0.	0.	0.	0.	0.
19	12	1	9.	11.	0.	0.	0.	27.	0.	0.
20	13	1	0.	0.	0.	0.	0.	0.	6.	0.
21	14	1	0.	2.	0.	0.	0.	0.	0.	0.
22	14	2	2.	14.	0.	0.	0.	2.	0.	0.
23	14	3	2.	12.	0.	0.	0.	3.	0.	0.
24	14	4	2.	3.	0.	0.	0.	0.	0.	0.
25	14	5	0.	3.	0.	0.	0.	0.	0.	0.

VNBR= 7.75 12.60 8.00 4.93 8.00 2.80 2.72 15.00 40.00 5.45 12.58 3.49 4.00 140.00

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

UPPER RIGHT OF MATRIX AT (ATTRITION)

SHOOTERS L	I	J	TARGETS 9	10	11	12	13	14
1	1	1	24.53	.00	.53	.00	.00	.00
2	2	1	.00	.13	1.53	.00	.00	.00
3	2	2	8.20	.20	2.00	.00	.00	.00
4	3	1	1.00	.00	.20	.00	.00	.00
5	4	1	12.13	.53	4.80	.00	.00	.00
6	5	1	.00	.00	.00	.40	.00	.00
7	6	1	.00	.06	.00	3.53	.00	.00
8	7	1	7.60	.20	3.20	.00	.00	.00
9	8	1	.90	.00	.33	.00	.00	.00
10	8	2	.00	.00	.00	.00	.00	.00
11	8	3	.00	.00	.00	.00	.00	.00
12	8	4	.20	.00	.13	.00	.00	.00

LOWER LEFT OF MATRIX AT (ATTRITION)

SHOOTERS L	I	J	TARGETS 1	2	3	4	5	6	7	8
13	9	1	2.60	.00	.00	.00	.00	.00	.00	.00
14	9	2	.00	.73	.00	.00	.00	.00	.00	.00
15	9	3	.00	.00	.00	.00	.00	.00	.00	.00
16	9	4	.00	.00	.00	.00	.00	.00	.00	.00
17	10	1	.20	.20	.00	.13	.00	.00	.13	.00
18	11	1	.33	.60	.00	.00	.00	.00	.00	.00
19	12	1	.60	.73	.00	.00	.00	1.80	.00	.00
20	13	1	.00	.00	.00	.00	.00	.00	.40	.00
21	14	1	.00	.13	.00	.00	.00	.00	.00	.00
22	14	2	.13	.93	.00	.00	.00	.13	.00	.00
23	14	3	.13	.80	.00	.00	.00	.20	.00	.00
24	14	4	.13	.20	.00	.00	.00	.00	.00	.00
25	14	5	.00	.20	.00	.00	.00	.00	.00	.00

COMPUTE WEAPON TYPE INTRINSIC VALUE

```
ITERATION  1
VV =   .1000+01  .1600+01  .1030+01  .1000+01  .1000+01  .1000+01  .1000+01  .1000+01  .4000+01  .1000+01
VV =   .1000+01  .1000+01  .1000+01  .1000+01
ITERATION  2
VV =   .6400+01  .1609+01  .2750+00  .6000+01  .5000-01  .1262+01  .6827+01  .4762-01  .7350-01  .1321+00
VV =   .8685-01  .9017+00  .1000+00  .2433-01
ITERATION  3
VV =   .8784+00  .2607+00  .4126-01  .9929+00  .4748-01  .1199+01  .1129+01  .8577-02  .1564+00  .2633+00
VV =   .1276+00  .1211+01  .2613+00  .2879-01
ITERATION  4
VV =   .1276+01  .3712+00  .5837-01  .1376+01  .5503-01  .1389+01  .1540+01  .1154-01  .5869-01  .1038+00
VV =   .4957-01  .7899+00  .1063+00  .1294-01
ITERATION  5
VV =   .7822+00  .2287+00  .3585-01  .8474+00  .4642-01  .1122+01  .9609+00  .7122-02  .7051-01  .1231+00
VV =   .5901-01  .8797+00  .1249+00  .1504-01
ITERATION  6
VV =   .8573+00  .2503+00  .3927-01  .9274+00  .4689-01  .1184+01  .1062+01  .7791-02  .5522-01  .9652-01
VV =   .4625-01  .7553+00  .9803-01  .1210-01
ITERATION  7
VV =   .7586+00  .2215+00  .3475-01  .8208+00  .4396-01  .1097+01  .9308+00  .6896-02  .5780-01  .1010+00
VV =   .4840-01  .7806+00  .1026+00  .1261-01
```

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

```
FINAL SOLUTION TO WEAPON TYPE INTRINSIC VALUE
VAL =    .8810   .2291   .4932   .1886   .9164   .2102  1.0561   .9759   .C838   .0000
FINAL SOLUTION TO WEAPON TYPE INTRINSIC VALUE
VAL =    .0000   .1918   .2172   .0898   .0000   .0000   .3082   .2134   .8637   .3106
FINAL SOLUTION TO WEAPON TYPE INTRINSIC VALUE
VAL =    .1456   .0979   .1148   .3769   .0728
```

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

X(L,K) MATRIX FOR DIRECT FIRE

L	I	J	9	10	11	12	13	14	
1	1	1	.6513	.9930	.9928	1.0000	1.0000	1.0000	4
2	2	1	1.0000	.9999	.9825	1.0000	1.0000	1.0000	3
3	2	2	.7721	.9983	.9686	.9962	1.0000	1.0000	4
4	3	1	.5093	1.0000	.9970	1.0000	1.0000	1.0000	4
5	4	1	.6918	.9946	.0756	1.0000	1.0000	1.0000	6
6	5	1	1.0000	1.0000	1.0000	.0033	1.0000	1.0000	3
7	6	1	1.0000	1.0000	1.0000	.5930	1.0000	1.0000	3
8	7	1	.6353	.9946	.0629	1.0000	1.0000	1.0000	6

L	I	J	1	2	3	4	5	6	7	8	
13	9	1	.0990	.9998	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	3
14	9	2	1.0000	.0545	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	4
15	9	3	1.0000	.9996	.9991	1.0000	1.0000	1.0000	1.0000	1.0000	3
16	9	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	3
17	10	1	.9899	.9682	.9676	.9995	1.0000	1.0000	.9996	1.0000	4
18	11	1	.9957	.9358	.9869	1.0000	1.0000	1.0000	1.0000	1.0000	4
19	12	1	.9058	.9577	.9126	1.0000	1.0000	.9785	1.0000	1.0000	5
20	13	1	1.0000	1.0000	1.0000	.8533	1.0000	1.0000	.6787	1.0000	7

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

A V A I L A B I L I T Y
FRACTION OF ASSESSMENT CYCLE TARGET IS AVAILABLE TO SHOOTER
UPPER RIGHT MATRIX A

L	I	J \ K=	9	10	11	12	13	14
1	1	1	.8894-02	.1287-02	.5734-03	.0000	.0000	.0000
2	2	1	.0000	.1709-04	.1400-02	.0000	.0000	.0000
3	2	2	.5375-02	.3091-03	.2534-02	.1040-02	.0000	.0000
4	3	1	.1096-01	.0000	.2376-03	.0000	.0000	.0000
5	4	1	.7698-02	.9969-03	.1051-01	.0000	.0000	.0000
6	5	1	.0000	.0000	.0000	.3306-01	.0000	.0000
7	6	1	.0000	.0000	.0000	.1320+00	.0000	.0000
8	7	1	.9406-02	.9966-03	.1165-01	.0000	.0000	.0000

LOWER LEFT MATRIX A

L	I	J \ K=	1	2	3	4	5	6	7	8
13	9	1	.1435-01	.1602-04	.0000	.0000	.0000	.0000	.0000	.0000
14	9	2	.0000	.1291-01	.8523-05	.0000	.0000	.0000	.0000	.0000
15	9	3	.0000	.2900-04	.1080-03	.0000	.0000	.0000	.0000	.0000
16	9	4	.0000	.0000	.0000	.0000	.4193-05	.0000	.0000	.0000
17	10	1	.1303-02	.2560-02	.4109-02	.9397-04	.0000	.0000	.1630-03	.0000
18	11	1	.5512-03	.5252-02	.1708-02	.0000	.0000	.0000	.0000	.0000
19	12	1	.1890-02	.3425-02	.1137-01	.0000	.0000	.7739-02	.0000	.0000
20	13	1	.0000	.0000	.0000	.3165-01	.0000	.0000	.1326+00	.0000

L MATRIX ARTILLERY (LETHALITY)

```
 1        .00000        .34256-03     .19929-03     .14999-02     .00000
 1        .00000        .16927-04     .15361-04     .60474-03     .00000
 1        .00000        .11998-04     .13448-04     .59414-03     .00000
      1      4      0     0
 2        .14390-01     .14910-02     .83327-03     .27920-02     .62377-03
 2        .21336-02     .18062-03     .95610-04     .70897-03     .16030-03
 2        .69162-03     .61062-04     .55132-04     .59439-03     .13005-03
 2        .61004-03     .55297-04     .53294-04     .58871-03     .13695-03
      2      5      0     0
      3      1      0     0
      4      1      0     0
      5      1      0     0
 6        .00000        .94850-03     .87669-03     .00000        .00000
 6        .00000        .88991-04     .96460-04     .00000        .00000
 6        .00000        .36379-04     .59359-04     .00000        .00000
 6        .00000        .34207-04     .57878-04     .00000        .00000
      6      5      0     0
      7      1      0     0
      8      1      0     0
 9        .29175-03     .00000        .00000        .47270-03
 9        .18302-03     .00000        .00000        .45383-03
      9      3      0     0
     10      1      0     0
11        .76879-03     .00000        .00000        .12179-02
11        .59090-03     .00000        .00000        .11491-02
     11      3      0     0
```

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

12	1	0	0
13	1	0	0
14	1	0	0

SAMPLE OUTPUT FROM PHASE I OF ATTRITION ALGORITHM (Continued)

A V A I L A B I L I T Y
FRACTION OF ASSESSMENT CYCLE TARGET IS AVAILABLE TO SHOOTER
UPPER RIGHT MATRIX A

L	I	J	K= 9	10	11	12	13	14
1	1	1	.8894-02	.1287-02	.5734-03	.0000	.0000	.0000
2	2	1	.0000	.1709-04	.1400-02	.0000	.0000	.0000
3	2	2	.5375-02	.3091-03	.2534-02	.1040-02	.0000	.0000
4	3	1	.1096-01	.0000	.2376-03	.0000	.0000	.0000
5	4	1	.7498-02	.9969-03	.1051-01	.0000	.0000	.0000
6	5	1	.0000	.0000	.0000	.3306-01	.0000	.0000
7	6	1	.0000	.0000	.0000	.1320+00	.0000	.0000
8	7	1	.9406-02	.9966-03	.1165-01	.0000	.0000	.0000
9	8	1	.1828-03	.0000	.5884-03	.0000	.0000	.0000
10	8	2	.0000	.0000	.0000	.0000	.0000	.0000
11	8	3	.0000	.0000	.0000	.0000	.0000	.0000
12	8	4	.4538-03	.0000	.1169-02	.0000	.0000	.0000

LOWER LEFT MATRIX A

L	I	J	K= 1	2	3	4	5	6	7	8
13	9	1	.1435-01	.1402-04	.0000	.0000	.0000	.0000	.0000	.0000
14	9	2	.0000	.1241-01	.8523-05	.0000	.0000	.0000	.0000	.0000
15	9	3	.0000	.2900-04	.1080-03	.0000	.0000	.0000	.0000	.0000
16	9	4	.0000	.0000	.0000	.0000	.4143-05	.0000	.0000	.0000
17	10	1	.1303-02	.2540-02	.4109-02	.9397-04	.0000	.0000	.1630-03	.0000
18	11	1	.5512-03	.5252-02	.1708-02	.0000	.0000	.0000	.0000	.0000
19	12	1	.1840-02	.3425-02	.1137-01	.0000	.0000	.7739-02	.0000	.0000
20	13	1	.0000	.0000	.0000	.3165-01	.0000	.0000	.1326+00	.0000
21	14	1	.0000	.6067-03	.0000	.0000	.0000	.0000	.0000	.0000
22	14	2	.1189-04	.5496-04	.0000	.0000	.0000	.3412-04	.0000	.0000
23	14	3	.1393-04	.5321-04	.0000	.0000	.0000	.5782-04	.0000	.0000
24	14	4	.5939-03	.5884-03	.0000	.0000	.0000	.0000	.0000	.0000
25	14	5	.0000	.1369-03	.0000	.0000	.0000	.0000	.0000	.0000

@XQT 24-ATRITT.FS2A

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM

PHASE 2 INPUTS

NUMBER OF BLUE VEHICLES 8 NUMBER OF RED VEHICLES 6

NUMBER OF DIRECT FIRE BLUE VEHICLES 7 NUMBER OF DIRECT FIRE RED VEHICLES 5

MATRIX P (PROBABILITY OF KILL GIVEN A SHOT,DIRECT FIRE ONLY)

UPPER RIGHT PORTION (BLUE VS. RED)

L	I	J	9	10	11	12	13	14
1	1	1	.277	.059	.310	.500	.500	.500
2	2	1	.500	.429	.180	.500	.500	.500
3	2	2	.440	.500	.633	.077	.500	.500
4	3	1	.163	.500	.800	.500	.500	.500
5	4	1	.729	.692	.768	.500	.500	.500
6	5	1	.500	.500	.500	.159	.500	.500
7	6	1	.500	.500	.500	.039	.500	.500
8	7	1	.714	.571	.893	.500	.500	.500
9	8	1	.000	.000	.000	.000	.000	.000
10	6	2	.000	.000	.000	.000	.000	.000
11	6	3	.000	.000	.000	.000	.000	.000
12	8	4	.000	.000	.000	.000	.000	.000

LOWER LEFT PORTION (RED VS. BLUE)

L	I	J	1	2	3	4	5	6	7	8
13	9	1	.026	.143	.590	.500	.500	.500	.500	.500
14	9	2	.500	.011	.250	.500	.500	.500	.500	.500
15	9	3	.500	.063	.091	.500	.500	.500	.500	.500
16	9	4	.500	.500	.500	.500	.250	.500	.500	.500
17	10	1	.286	.286	.260	.750	.500	.500	.750	.500
18	11	1	.353	.217	.260	.500	.500	.500	.500	.500
19	12	1	.313	.353	.143	.500	.500	.378	.500	.500
20	13	1	.500	.500	.500	.016	.500	.500	.029	.500
21	14	1	.000	.000	.000	.000	.000	.000	.000	.000
22	14	2	.000	.000	.000	.000	.000	.000	.000	.000
23	14	3	.000	.000	.000	.000	.000	.000	.000	.000
24	14	4	.000	.000	.000	.000	.000	.000	.000	.000
25	14	5	.000	.000	.000	.000	.000	.000	.000	.000

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

MATRIX A (INDIRECT FIRE LETHALITIES)

UPPER RIGHT PORTION (BLUE VS. RED)

L	I	J	9	10	11	12	13	14
1	1	1	.869-02	.129-02	.573-03	.000	.000	.000
2	2	1	.000	.171-04	.140-02	.000	.000	.000
3	2	2	.530-02	.309-03	.253-02	.104-02	.000	.000
4	3	1	.110-01	.000	.238-03	.000	.000	.000
5	4	1	.765-02	.997-03	.105-01	.000	.000	.000
6	5	1	.000	.000	.000	.331-01	.000	.000
7	6	1	.000	.000	.000	.132+00	.000	.000
8	7	1	.941-02	.997-03	.117-01	.000	.000	.000
9	8	1	.183-03	.000	.580-03	.000	.000	.000
10	8	2	.000	.000	.000	.000	.000	.000
11	8	3	.000	.000	.000	.000	.000	.000
12	8	4	.959-03	.000	.117-02	.000	.000	.000

LOWER LEFT PORTION (RED VS. BLUE)

L	I	J	1	2	3	4	5	6	7	8
13	9	1	.149-01	.160-04	.000	.000	.000	.000	.000	.000
14	9	2	.000	.124-01	.852-05	.000	.000	.000	.000	.000
15	9	3	.000	.290-04	.198-03	.000	.000	.000	.000	.000
16	9	4	.000	.000	.000	.000	.414-05	.000	.000	.000
17	10	1	.130-02	.256-02	.411-02	.990-04	.000	.000	.163-03	.000
18	11	1	.561-03	.625-02	.171-02	.000	.000	.000	.000	.000
19	12	1	.189-02	.343-02	.119-01	.000	.000	.779-02	.000	.000
20	13	1	.000	.000	.000	.316-01	.000	.000	.133+00	.000
21	14	1	.000	.607-03	.000	.000	.000	.000	.000	.000
22	14	2	.119-04	.550-04	.000	.000	.000	.391-04	.000	.000
23	14	3	.139-04	.532-04	.000	.000	.000	.578-04	.000	.000
24	14	4	.599-03	.580-03	.000	.000	.000	.000	.000	.000
25	14	5	.000	.137-03	.000	.000	.000	.000	.000	.000

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

MATRIX D (COUNTERBATTERY ALLOCATION OF ARTILLERY)

UPPER RIGHT PORTION (BLUE VS. RED)

L	I	J	9	10	11	12	13	14
1	1	1	1.000	1.000	1.000	1.000	1.000	.000
2	2	1	1.000	1.000	1.000	1.000	1.000	.000
3	2	2	1.000	1.000	1.000	1.000	1.000	.000
4	3	1	1.000	1.000	1.000	1.000	1.000	.000

LOWER LEFT PORTION (RED VS. BLUE)

L	I	J	1	2	3	4	5	6	7	8
5	4	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.000
6	5	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.000
7	6	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.000
8	7	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.000
9	8	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.000

EPS = .01000

RATE OF FIRE BLUE	33.0	41.0	7.0	2.0	12.0	3.0	80.0	12.0	1.4	1.2	.4	2.4	
RATE OF FIRE RED	20.0	10.0	26.0	84.0	5.0	4.0	14.0	12.0	6.5	20.6	24.7	20.1	7.2
RANGE FOR BLUE	3.0	2.0	3.2	1.5	10.0	3.0	4.5	10.0	.0	.0	.0	.0	
RANGE FOR RED	3.0	3.0	1.1	1.2	5.0	5.0	10.0	6.5	.0	.0	.0	.0	.0

VEHICLE K	WEAPON TYPES	NUMBER OF VEHICLES	
1	1	10.0	BLUE
2	2	15.0	BLUE
3	1	8.0	BLUE
4	1	5.0	BLUE
5	1	8.0	BLUE
6	1	4.0	BLUE
7	1	3.0	BLUE
8	4	35.0	BLUE
9	4	80.0	RED
10	1	6.0	RED
11	1	20.0	RED
12	1	6.0	RED
13	1	4.0	RED
14	5	148.0	RED

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

```
MATRIX    AP   (SCALED AVAILABILITY FOR DIRECT FIRE)

                 UPPER RIGHT PORTION  (BLUE VS. RED)
 L   I   J      9         10        11        12        13        14
 1   1   1   .889-02   .129-02   .573-03   .000      .000      .000
 2   2   1   .000      .171-04   .140-02   .000      .000      .000
 3   2   2   .538-02   .309-03   .253-02   .104-02   .000      .000
 4   3   1   .110-01   .000      .238-03   .000      .000      .000
 5   4   1   .765-02   .997-03   .105-01   .000      .000      .000
 6   5   1   .000      .000      .000      .331-01   .000      .000
 7   6   1   .000      .000      .000      .132+00   .000      .000
 8   7   1   .941-02   .997-03   .117-01   .000      .000      .000
 9   8   1   .000      .000      .000      .000      .000      .000
10   8   2   .000      .000      .000      .000      .000      .000
11   8   3   .000      .000      .000      .000      .000      .000
12   8   4   .000      .000      .000      .000      .000      .000

                 LOWER LEFT PORTION  (RED VS. BLUE)
 L   I   J      1         2         3         4         5         6         7         8
13   9   1   .144-01   .160-04   .000      .000      .000      .000      .000      .000
14   9   2   .000      .124-01   .852-05   .000      .000      .000      .000      .000
15   9   3   .000      .290-04   .100-03   .000      .000      .000      .000      .000
16   9   4   .000      .000      .000      .000      .419-05   .000      .000      .000
17  10   1   .130-02   .256-02   .911-02   .940-04   .000      .000      .163-03   .000
18  11   1   .551-03   .525-02   .171-02   .000      .000      .000      .000      .000
19  12   1   .164-02   .343-02   .114-01   .000      .000      .779-02   .000      .000
20  13   1   .000      .000      .000      .316-01   .000      .000      .133+00   .000
21  14   1   .000      .000      .000      .000      .000      .000      .000      .000
22  14   2   .000      .000      .000      .000      .000      .000      .000      .000
23  14   3   .000      .000      .000      .000      .000      .000      .000      .000
24  14   4   .000      .000      .000      .000      .000      .000      .000      .000
25  14   5   .000      .000      .000      .000      .000      .000      .000      .000

VV(K) =    .1000+01   .1000+01   .1000+01   .1000+01   .1000+01   .1000+01   .1000+01   .1000+01   .4000+01   .1000+01
           .1000+01   .1000+01   .1000+01   .1000+01
  N-BAR(K) =   8.62  13.07   7.71   4.98   7.99   3.62   2.08  35.00  62.41   5.96
  N-BAR(K) =  10.13   4.67   4.00 148.00

VV(K) =    .4467+01   .2515+01   .3894+00   .4405+01   .8717-01   .1866+01   .1033+02   .7835-01   .1076+00   .1365+00
           .1036+00   .4928+00   .1394+00   .2978-01
  N-BAR(K) =   7.77  12.51   7.79   4.95   7.98   3.50   2.80  35.00  55.58   5.82
  N-BAR(K) =  15.09   4.00   4.00 148.00

VV(K) =    .1309+01   .3904+00   .6272-01   .1429+01   .6902-01   .1520+01   .1613+01   .1350-01   .2207+00   .3216+00
           .1052+00   .1809+01   .4365+00   .3836-01
  N-BAR(K) =   7.62  12.43   7.84   4.93   7.98   3.16   2.75  35.00  52.12   5.70
  N-BAR(K) =  13.93   3.67   4.00 148.00

VV(K) =    .1712+01   .4878+00   .7885-01   .1824+01   .8081-01   .1836+01   .2659+01   .1621-01   .7598-01   .1204+00
           .6385-01   .4729+00   .1692+00   .1608-01
  N-BAR(K) =   7.59  12.42   7.87   4.92   7.98   3.03   2.73  35.00  50.37   5.62
  N-BAR(K) =  13.39   3.56   4.00 148.00

VV(K) =    .4554+00   .2703+00   .4399-01   .1020+01   .6457-01   .1260+01   .1153+01   .8865-02   .8518-01   .1362+00
           .7217-01   .1034+01   .1891+00   .1748-01
  N-BAR(K) =   7.61  12.44   7.88   4.92   7.98   2.93   2.72  35.00  49.44   5.57
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SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

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  N-BAR(K) =  13.10   3.53   9.00 148.00

VV(K) =    .9847+00   .2780+00   .4532-01   .1053+01   .4467-01   .1249+01   .1192+01   .9063-02   .6336-01   .1017+00
          .5377-01   .8378+00   .1407+00   .1317-01
  N-BAR(K) =   7.63  12.46   7.89   4.92   7.98   2.90   2.71  35.00  48.93   5.54
  N-BAR(K) =  12.96   3.53   9.00 148.00

VV(K) =    .8378+00   .2359+00   .3853-01   .8757+00   .4086-01   .1136+01   .1015+01   .7667-02   .6448-01   .1033+00
          .5472-01   .8312+00   .1427+00   .1327-01
  N-BAR(K) =   7.65  12.47   7.89   4.92   7.98   2.87   2.71  35.30  48.63   5.52
  N-BAR(K) =  12.89   3.55   9.06 148.00

VV(K) =    .8374+00   .2350+00   .3855-01   .8763+00   .4075-01   .1133+01   .1016+01   .7653-02   .5957-01   .9633-01
          .5055-01   .7820+00   .1314+00   .1228-01
  N-BAR(K) =   7.66  12.48   7.89   4.92   7.98   2.85   2.71  35.00  48.46   5.52
  N-BAR(K) =  12.85   3.56   9.00 148.00

VV(K) =    .8011+00   .2254+00   .3688-01   .8577+00   .4745-01   .1162+01   .9720+00   .7313-02   .5970-01   .9590-01
          .5065-01   .7781+00   .1314+00   .1226-01
  N-BAR(K) =   7.67  12.49   7.90   4.92   7.98   2.89   2.71  35.00  48.36   5.61
  N-BAR(K) =  12.83   3.57   9.00 148.00

VV(K) =    .7997+00   .2250+00   .3682-01   .8564+00   .4752-01   .1103+01   .9707+00   .7296-02   .5847-01   .9339-01
          .4959-01   .7650+00   .1285+00   .1201-01
```

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

** RESULTS **

VEHICLE RESULTS

I	N(I)	FN(I)	N-BAR	I**2	(N-BAR)I**2	FORCE SUM
1	10.0	.5791+01	7.67	.7997+00	.6131+01	
2	15.0	.1028+02	12.49	.2250+00	.2810+01	
3	8.0	.7796+01	7.90	.3682-01	.2907+00	
4	5.0	.4834+01	4.92	.8544+00	.4210+01	
5	8.0	.7964+01	7.98	.4762-01	.3793+00	
6	4.0	.1914+01	2.84	.1103+01	.3134+01	
7	3.0	.2438+01	2.71	.9707+00	.2630+01	
8	35.0	.3500+02	35.00	.7296-02	.2554+00	
						.1989+02
9	80.0	.2628+02	48.36	.5847-01	.2827+01	
10	6.0	.5044+01	5.51	.9334-01	.5146+00	
11	20.0	.7594+01	12.83	.4959-01	.6363+00	
12	6.0	.1927+01	3.57	.7658+00	.2737+01	
13	4.0	.4000+01	4.00	.1285+00	.5141+00	
14	148.0	.1480+03	148.00	.1201-01	.1777+01	
						.9007+01

WEAPON WORTHS

I(I)**2	
.7997+00	1
.3267-01	2
.2058+00	3
.3682-01	4
.8564+00	5
.4762-01	6
.1103+01	7
.9707+00	8
.7261-02	9
.0000	10
.0000	11
.2078-01	12
.4956-01	13
.7969-02	14
.7828-03	15
.1513-03	16
.9334-01	17
.4959-01	18
.7658+00	19
.1285+00	20
.2120-01	21
.9651-02	22
.1330-01	23
.1433+00	24
.5248-02	25

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

MATRIX AT (ATTRITION)

UPPER RIGHT PORTION (BLUE VS. RED)

L	I	J	9	10	11	12	13	14
1	1	1	24.465	.054	.570	.000	.000	.000
2	2	1	.000	.077	.961	.000	.000	.000
3	2	2	8.204	.184	2.050	.050	.000	.000
4	3	1	1.038	.000	.165	.000	.000	.000
5	4	1	12.891	.467	4.940	.000	.000	.000
6	5	1	.000	.000	.000	.430	.000	.000
7	6	1	.000	.000	.000	3.567	.000	.000
8	7	1	7.530	.175	3.266	.000	.000	.000
9	8	1	.404	.000	.341	.000	.000	.000
10	8	2	.000	.000	.000	.000	.000	.000
11	8	3	.000	.000	.000	.000	.000	.000
12	8	4	.202	.000	.136	.000	.000	.000

LOWER LEFT PORTION (RED VS. BLUE)

L	I	J	1	2	3	4	5	6	7	8
13	9	1	2.459	.046	.000	.000	.000	.000	.000	.000
14	9	2	.000	.799	.034	.000	.000	.000	.000	.000
15	9	3	.000	.057	.056	.000	.000	.000	.000	.000
16	9	4	.000	.000	.000	.000	.034	.000	.000	.000
17	10	1	.232	.224	.034	.102	.000	.000	.102	.000
18	11	1	.365	.640	.035	.000	.000	.000	.000	.000
19	12	1	.599	.700	.046	.000	.000	1.763	.000	.000
20	13	1	.000	.000	.000	.064	.000	.000	.461	.000
21	14	1	.000	.132	.000	.000	.000	.000	.000	.000
22	14	2	.132	.925	.000	.000	.000	.136	.000	.000
23	14	3	.132	.793	.000	.000	.000	.204	.000	.000
24	14	4	.132	.198	.000	.000	.000	.000	.000	.000
25	14	5	.000	.198	.000	.000	.000	.000	.000	.000

SAMPLE OUTPUT FROM PHASE II OF ATTRITION ALGORITHM (Continued)

MATRIX OF ROUNDS FIRED PER WEAPON TYPE

UPPER RIGHT PORTION (BLUE VS. RED)

L	I	J	9	10	11	12	13	14
1	1	1	88.381	.917	1.069	.000	.000	.000
2	2	1	.000	.180	5.327	.000	.000	.000
3	2	2	10.327	.368	3.253	.697	.000	.000
4	3	1	6.355	.000	.207	.000	.000	.000
5	4	1	16.584	.675	6.429	.000	.000	.000
6	5	1	.000	.000	.000	2.703	.000	.000
7	6	1	.000	.000	.000	90.431	.000	.000
8	7	1	7.538	.175	3.266	.000	.000	.000

LOWER LEFT PORTION (RED VS. BLUE)

L	I	J	1	2	3	4	5	6	7	8
13	9	1	101.946	.323	.000	.000	.000	.000	.000	.000
14	9	2	.000	69.812	.138	.000	.000	.000	.000	.000
15	9	3	.000	.919	.611	.000	.000	.000	.000	.000
16	9	4	.000	.000	.000	.000	.135	.000	.000	.000
17	10	1	.811	.786	.135	.136	.000	.000	.135	.000
18	11	1	1.035	2.993	.138	.000	.000	.000	.000	.000
19	12	1	1.918	1.983	.321	.000	.000	4.659	.000	.000
20	13	1	.000	.000	.000	3.998	.000	.000	16.131	.000

SAMPLE OUTPUT FROM PHASE II ATTRITION ALGORITHM (Continued)

AMMUNITION EXPENDITURE FOR DIRECT FIRE WEAPONS

1	.9116+02	BLUE	1	1
2	.5507+01	BLUE	2	1
3	.2260+02	BLUE	2	2
4	.6561+01	BLUE	3	1
5	.2369+02	BLUE	4	1
6	.2763+01	BLUE	5	1
7	.9043+02	BLUE	6	1
8	.1098+02	BLUE	7	1
13	.1018+03	RED	9	1
14	.6995+02	RED	9	2
15	.1538+01	RED	9	3
16	.1346+00	RED	9	4
17	.2003+01	RED	10	1
18	.4116+01	RED	11	1
19	.8881+01	RED	12	1
20	.2013+02	RED	13	1

GPRT,S 29-ATRITT.FSI/COSAGE
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